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Studies in the Asclepiadaceae — VIII

A NEW SPECIES OF ASCLEPIAS FROM KANSAS AND TWO POSSIBLE HYBRIDS FROM NEW YORK

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(WITH PLATES 16–19)

Asclepias kansana sp. nov.

Stems erect, very stout, canescently tomentose throughout, 2 dm. (or more?) high: leaves approximately opposite, short-petioled; basal blades broadly oblong-ovate, truncate and rounded at the base, obtuse and mucronulate or emarginate at the apex, the upper ones elliptical-oblong, also mucronulate or more often emarginate, the lower ones 13–16 cm. or more long, 9–11 cm. wide, the upper ones 9–14 cm. long and 4.5–9 cm. wide, minutely tomentose or becoming glabrate above, densely canescently tomentose beneath, becoming less so with age, the midvein very broad and conspicuous, the primary veins wide-spreading; petioles stout, 1–1.5 cm. long: umbels several, axillary on the upper part of the stem, peduncled, many-flowered; peduncle 3–7 cm. long; pedicels 2–3 cm. long, tomentose: calyx-segments oblong-lanceolate: corolla-segments (pink-purple?), oblong, 7–8 mm. long, tomentose on the outside; hoods oblong, about 4 mm. long, erect but diverging at the obtuse apex (pinkish?), the lateral margins infolded with a broad obtuse tooth on each side at about the middle, the tips of which meet under the exserted incurving horn; horn falcate, affixed near the base of the hood, and incurving over the edge of the anthers: follicles erect, on recurved pedicles, 8–10 cm. long, 3–3.5 cm. wide, obtuse at the curved apex, densely white-tomentose, echinate with numerous soft spinose processes that vary in length from 3–10 mm.; seeds 8 mm. long. (PLATE 16, FIGURE 4; PLATE 18.)

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Kansas: Fort Riley, *E. E. Gayle 514*, June 24, 1892; Manhattan, Riley County, *W. A. Kellerman*, 1890; Riley County, *J. B. Norton 762*, 1896 (type, in the Herbarium of the New York Botanical Garden.)

A specimen labelled *A. syriaca* L. from Independence, Mo., *B. F. Bush 355*, June, 1895, might be referred here, the leaf-characters being clearly those of *A. kansana*, but the flowers are in too poor condition to study. A specimen from Osborne County, Kansas, *C. L. Shear 130*, June 22, 1894, also labelled *A. syriaca* L., without flowers, appears to belong here.

Differing from *Asclepias syriaca* L. in its broader oblong-ovate and oblong-elliptical leaves, in the erect-spreading hoods that are narrower at the apex, and in the character and greater number of the processes of the densely tomentose follicles.

Asclepias syriaca L. from the Eastern States has longer, narrower, more acute leaves, shorter, more rounded and erect corolla-hoods and follicles that are much less tomentose and have fewer and much shorter processes. (PLATE 16, FIGURES 1*a* and 1*b*; PLATE 17, FIGURE 1, *a–f*.)

Asclepias Bicknellii sp. nov.

Stems erect, glabrous or strigilose in lines above, glaucous, 3 dm. or more high: leaves opposite, short-petioled; blades oblong or the upper ones elliptical-oblong, 11–16 cm. long, 3.5–8 cm. wide, acute at the apex, truncate or rounded or sometimes subcordate at the base, glabrous or nearly so above, paler, glaucous and sparingly strigilose beneath, undulate on the margins; petioles 2–5 mm. long: umbels terminal and axillary; peduncles 6–9 cm. long, strigilose; pedicels slender, 2–2.5 cm. long, strigose: calyx-segments ovate-lanceolate, acute, glabrate; corolla-segments oblong, 7 mm. long, pale greenish, tinged with purple, glabrous; hoods erect, 4 mm. high, rounded and somewhat pendulous at the saccate base, pale pink, crenately notched or undulate at the apex; horn falcate, flat, arising from the base of the hood, long-exserted over the anthers: follicles not known. (PLATE 19.)

Van Cortlandt Park, New York City, collected by E. P. Bicknell, June 25, 1895. Type in the Herbarium of Columbia University (N. Y. Botanical Garden).

A possible hybrid appearing to be intermediate between *A. syriaca* L. and *A. amplexicaulis* Smith or *A. exaltata* (L.) Muhl. Named in honor of Mr. E. P. Bicknell.

A single plant found growing on a railroad embankment with *A. syriaca* L., "and *A. purpurascens* L. a not distant neighbor" (Bicknell in litt.). Its leaves resemble closely those of *A. purpurascens* L., but with the undulate marginal characters of *A. amplexicaulis* Smith; but the flower and hood characters are nearer those of *A. exaltata* (L.) Muhl. than of any of the other related Northeast American species. The leaves of *A. exaltata* are very thin and acute at each end, those of *A. Bicknellii* being more nearly of the texture of those of *A. syriaca*, but without the canescent pubescence of the latter species. *A. exaltata* was not known to grow in the vicinity.

Asclepias intermedia sp. nov.

Stems erect, glabrous, purplish, not glaucous, 3 dm. or more high: leaves opposite, on very short but distinct petioles, or possibly the lowest sessile; blades oblong-elliptical, thinnish, yellow-green and glabrous above, paler and minutely pubescent beneath, the midvein reddish above, the primary veins wide-spreading, also tinged with red, 8–14 cm. long, 3–7 cm. wide, obtuse or the upper ones subcordate at the base, obtuse and apiculate at the apex, most of the margins undulate; petioles 1–3 mm. long: umbels terminal, 2 or more, short-peduncled, or subtended by an upper leaf, 16–24-flowered; peduncles minutely and sparingly pubescent, 2–8 cm. long; pedicels 2.5–3 cm. long, slender, minutely pubescent: calyx-segments ovate, acute, pubescent, especially toward the apex; corolla green-purple, its segments oblong-lanceolate, 6–8 mm. long; hoods erect, ovate-lanceolate, obtuse, 5–6 mm. long, pinkish purple with a darker red or purplish stripe down the back, the lateral margins incurved, each with an erect tooth somewhat above the middle; horn slender, arising from about the middle of the hood, the tips incurved and meeting over the anthers; follicles not known. (PLATE 16, FIGURE 2; PLATE 17, FIGURE 2, *a–f*.)

Lawrence, Long Island, collected by E. P. Bicknell, July 17, 1904. Type in the Herbarium of the New York Botanical Garden.

A possible hybrid. It appears to be intermediate between *Asclepias syriaca* L. (PLATE 16, FIGURE 1 *a*, 1 *b*; PLATE 17, FIGURE 1, *a–f*) and *A. amplexicaulis* Smith (PLATE 16, FIGURE 3; PLATE 17, FIGURE 3, *a–f*). It differs from the latter in its narrower, brighter green leaves that are distinctly petioled and pubescent beneath, and also somewhat less undulate on the margins. The umbels resemble

those of *A. syriaca* in contrast to the long-peduncled terminal umbels of *A. amplexicaulis*. The flowers are intermediate between the two species, with the characteristic distinct stripe down the back of the hood that appears in fresh specimens of *A. amplexicaulis*. The hoods of *A. amplexicaulis* vary very greatly in size, and in the undulations of their apical margins.

NEW YORK BOTANICAL GARDEN.

Explanation of plates 16-19

PLATE 16

1a. *Asclepias syriaca* L., follicle. *1b*. *Asclepias syriaca* L., leaf. 2. *Asclepias intermedia* Vail, leaf. 3. *Asclepias amplexicaulis* Smith, leaf. 4. *Asclepias kansana* Vail, follicle.

Figures *1a*, *1b* and 3 were drawn from fresh material; 2, from the fresh type specimen; 4, from specimen collected by W. A. Kellerman, 1890. All figures ⅔ nat. size.

PLATE 17

1. *Asclepias syriaca* L. 2. *Asclepias intermedia* Vail. 3. *Asclepias amplexicaulis* Smith.

Figures 1 and 3 were drawn from fresh material; 2, from type specimen.

In each case *a*, flower, × 2. *b*, calyx-segments, × about 6. *c*, hood, front view, × about 6. *d*, hood, side view, × about 6. *e*, gynostegium, × about 6. *f*, pollinia, × 14.

PLATE 18

Asclepias kansana Vail. *a*, flower. *b*, calyx-segments. *c*, hood, front view. *d*, hood, side view. *e*, gynostegium. *f*, pollinia. *g*, basal leaf. *h*, upper stem leaf. The figures were all drawn from *no. 762*, collected by J. B. Norton, 1896.

PLATE 19

Asclepias Bicknellii Vail. *a*, flower. *b*, calyx-segments. *c*, hood, front view. *d*, hood, side view. *e*, gynostegium. *f*, pollinia. *g*, basal leaf. *h*, stem leaf. The figures were all drawn from the type specimen, when fresh.

The North American species of Hymenoxys

T. D. A. Cockerell

(With plates 20–23)

Much interest has been excited in Colorado by the discovery of the existence of rubber in the roots of the plant recently described as *Picradenia floribunda utilis*. It appears that sheep-herders have for years been in the habit of chewing the roots of this plant, obtaining thereby a product which served for chewing-gum. Mr. F. R. Marsh, of Denver, conceived the idea of turning this substance to commercial use, and at the present time arrangements are being made for its extraction on a large scale. When Mr. Marsh presented the matter to me, asking that it should be investigated, I was naturally quite skeptical; but my wife undertook to make the necessary chemical tests, and obtained the excellent results she has described in *Science* (II. **19**: 314. 19 F 1904).

In Colorado, the plant in question is sometimes referred to as rabbit-weed; but I believe that several *Compositae* are confused under this name. Mr. E. C. Van Diest tells me that the Mexicans call it *penguè*, but here again it may be that two or more things are confused. He states that it is poisonous to sheep in the spring — probably on account of its mechanical rather than its chemical properties.

Finding the plant of so much interest, I undertook a botanical investigation of it and its allies. It soon became apparent that the whole genus required revision, and this paper was accordingly prepared. The possibility of the undertaking has depended entirely upon the kindness with which several botanists responded to my requests for the loan of specimens, Dr. Rose sending all the material of the National Museum, Dr. Trelease that of the Missouri Botanical Garden, Miss Eastwood that of the California Academy of Sciences, Prof. Aven Nelson that of the University of Wyoming, Prof. E. O. Wooton that of the New Mexico Agricultural College, and his own herbarium; and last but not least, Dr. E. L. Greene

sent a series of especially interesting and important plants from his collection. To all of these my thanks are due.

Hymenoxys is separated from *Actinella* (which includes our *Picradenia*) in the Genera Plantarum of Bentham & Hooker, but anyone who will compare the description will see that no substantial difference is indicated. Gray in the Synoptical Flora, treats *Hymenoxys* as a synonym of *Actinella*, referable to the section of that genus which includes *Picradenia*. Greene and others, seeing that typical *Hymenoxys* was a rayless plant of South America, felt satisfied that *Picradenia* was distinct, and I had adopted this view without serious misgivings. At Kew Herbarium, however, I have been able to examine species of *Hymenoxys*, and much to my regret (on account of the nomenclatural changes it compels) I am quite unable to separate the South American genus from *Picradenia*. In the herbarium, indeed, *Actinella chrysanthemoides* is placed in the *Hymenoxys*-cover, though it is absolutely congeneric with our plants of Texas, etc. There is nothing in the structure or habit to separate *Hymenoxys* from *Picradenia*, and the absence of rays cannot be considered important, as they may or may not be present in *Gaillardia*, and moreover *Hymenoxys Tweediei* Hook & Arn., from Uruguay, has very well-developed rays. This *H. Tweediei*, in its foliage and manner of growth, closely imitates our *H.* (or *Picradenia*) *Lemmoni*. *Hymenoxys Haenkeana* DC. has heads not unlike those of the Mexican *H. chrysanthemoides*. *Hymenoxys anthemoides* Cass., which is typical of the genus, looks just like our annual plants of the forms intermediate between *chrysanthemoides* and *multiflora*. The material examined has dark red pappus-scales and hairs on the achenes just as in some of our *Picradenia* forms.

The separation of *Tetraneuris*, *Rydbergia* and *Macdougalia** from *Hymenoxys* appears to be justified. *Actinella Palmeri* Gray, 1883, forms still another genus; taking up the subgeneric name proposed by Gray, it becomes **Plateilema Palmeri.** It is not only very distinct in its foliage and manner of growth, but its angular achenes, with ciliate margins, are very distinctive, not to mention the peculiar

* *Macdougalia* has only one known species, *M. Bigelovii* (Gray) Heller. This is cited in the Synoptical Flora only from New Mexico, but I have examined material (hb. U. S. Nat. Mus.) from San Francisco Mountain (*Jones*), near Flagstaff, 5500 ft. (*MacDougal*), Willow Spring (*Palmer*) and Williams (*Rusby*,) all in Arizona.

bracts. On the other hand, the fibrillose receptacle is not an absolute character to separate *Gaillardia* from *Hymenoxys*. As a matter of fact the broad-receptacled species of *Hymenoxys* do have the lowermost of the achene-hairs attached to the rim of the achene socket, and if the achenes are carefully removed the receptacle seems more or less fibrillose. Moreover there are admitted into the genus *Flaveria* two species (*F. australasica* and *F. repanda*) in which the receptacle is setose, while in the rest of the species it is bare. On other characters, I think *Gaillardia* is quite sufficiently distinct from *Hymenoxys*, but it is difficult to express the peculiarities in a rigid mechanical way. *Phileozera* is no doubt a valid subgenus; with the help of a little imagination, one could almost believe it to have originated independently from some Anthemoid ancestor. I do not suppose, however, that anything of this sort has really taken place; it is possible for Anthemoid characters to arise among the Helenioids, even so as to deceive the very elect. Most assuredly *Leucampyx Newberryi* Gray, placed by its author as the first genus of Anthemideae, is nothing but a rayed *Hymenopappus*; related, of course, to *H. radiatus* Rose. If we are to keep up the genus *Leucampyx*, certainly *H. radiatus* must be included. I have studied both it and *L. Newberryi* in the living state, and they look as much alike as they could without being quite the same.

The more essential characters of *Hymenoxys* are found in the hairy and usually slender achenes; the pappus-scales; the bracts of the involucre in two series, the outer united basally; the strongly punctate foliage, usually linear or divided into linear divisions. The genus is remarkably conservative in regard to these things, and yet in many other respects extremely plastic. The combination of great racial variability with a marked ability to become directly modified by existing conditions makes it unusually hard accurately to define the species and subspecies.

SUMMARY OF THE CLASSIFICATION

Subgenus **Picradenia** (Hook. 1833)

Plants with the aspect of *Gaillardia* or *Helenium*, the stems almost always erect; foliage linear or divided into linear segments, punctate; inner bracts almost always conspicuously different from the outer, and fimbriate; disc-corollas not expanded at the mouth; rays well-developed. Perennials or biennials, never annuals. Type, *H. Richardsoni*.

A. Plants less than 20 cm. high; perennials with large roots, and many stems; inflorescence usually flat-topped, not spreading; pappus-scales long-acuminate or aristate.

1. Pappus-scales not half length of disc-corolla; heads large. (Saskatchewan.) *H. Richardsoni.*

Pappus-scales more than half length of disc-corolla. 2.

2. Plant normally much over 10 cm. high, with large heads. 3.

Plant normally over 10 cm. high, with medium-sized heads; pappus-scales normally about three quarters length of disc-corolla. (Helena, Montana, through middle Wyoming to the extreme north of Colorado.) *H. Richardsoni liguiæflora.*

Plant normally under 10 cm. high, heads medium-sized. 4.

3. Heads up to 2 cm. across, exclusive of rays. (Wyoming.) *H. Richardsoni macrantha Nelsoni.*

Heads 12 to 16 mm. across, exclusive of rays; rays very conspicuous; pappus-scales normally about two thirds length of disc-corolla. (South central Wyoming and the mountains of the northern half of Colorado.) *H. Richardsoni macrantha.*

Heads about 10 mm. across, exclusive of rays; foliage and bracts paler than in the last, and the rays shorter. (Utah.) *H. Richardsoni macrantha Utahensis.*

4. Flowers rather inconspicuous; foliage pale and wiry. (Western Wyoming to the mountains of Southern Utah.) *H. Richardsoni pumila.*

Flowers more conspicuous, with large rays; inner bracts gradually tapering to apex. (Assiniboia.) *H. Richardsoni pumila Macouni.*

B. Plants normally 25 cm. high or more, with straight erect stems, and very numerous medium-sized heads (6 to 8 mm. diam. excl. rays); perennials with large roots.

1. Stems not very numerous, scarcely at all woolly at base; heads rather flat; outer bracts conspicuously tipped with dark green; pappus-scales short-pointed; leaf-segments up to 2.5 mm. broad. (Mancos, Colo.) *H. Earlei.*

Stems usually very numerous, often very woolly at base; heads more convex; leaf-segments very narrow, normally not over 1 mm. broad. 2.

2. Well-developed plants 30 cm. high; stems not very woolly at base; pappus and achene-hairs normally more or less ferruginous, pappus-scales long-pointed. (Southern central Colorado and northern New Mexico.) *H. floribunda.*

Well-developed plants about 26 cm. high; stems very woolly at base; pappus and achene-hairs normally shining silvery-white. (Buena Vista and adjacent parts of Colorado, at 2,280–3,000 m.) *H. floribunda utilis.*

Differs from the last two by the short-pointed pappus-scales; stems not very woolly at base; heads rather large. (San Francisco Mountain region of Arizona.) *H. floribunda arizonica.*

Plant more slender, pale; achene-hairs pale ferruginous; pappus-scales fairly long-pointed, with ferruginous base. (Arizona and New Mexico.) *H. floribunda intermedia.*

C. Plant when well-developed 36 cm. high, similar in mode of growth to the last group; stems and foliage a lively green; basal leaves up to about 7 cm. long, some entire, but always some divided into about five broad-linear segments; bracts light green; rays brilliant orange; pappus scales long-acuminate. (Burro Mountains, New Mexico.) *H. Metcalfii.*

D. Plants of the arid southwest, usually in the mountains, with the pappus-scales always very short, often truncate or subtruncate.

1. Tall and bushy, with very numerous rather small heads; rays inconspicuous, but the disc-florets prominent and bright orange; pappus very short; basal leaves all simple and grass-like. (Southwestern New Mexico, and Arizona.) *H. Rusbyi.*

Heads usually quite large; plant spreading above; rays conspicuous. 2.

2. Heads (excl. rays) only about 10 mm. broad; outer bracts united about half-way up. (Organ Mountains, New Mexico.) *H. Vaseyi.*

Heads considerably larger, usually less numerous; plant taller than the last, generally less leafy. 3.

3. Pappus-scales deep ferruginous, with a sort of purplish tint; rays comparatively narrow. (Mohave district of California.) *H. Cooperi.*

Pappus-scales normally white; rays broad. (Southeastern Arizona.) *H. Cooperi Grayi.*

Plant with a single rather slender stem, rather like *H. canescens biennis;* pappus silvery-white; rays narrow. (Grand Cañon of the Colorado.) *H. Cooperi argyrea.*

E. Moderate-sized apparently perennial plants, not over 30 cm. high in the material seen; heads fairly large, but not over 13 mm. broad (excl. rays); basal leaves all entire; pappus-scales aristate or long-pointed.

1. Pale and canescent; heads (excl. rays) 10–13 mm. diameter; cauline leaves broader and more lobed than in the next. (Arizona, 2,280 m.) *H. subintegra.*

Dark olivaceous; heads (excl. rays) 8–10 mm. diameter; pappus-scales not so long as in the last. (New Mexico.) *H. olivacea.*

F. Tall (rarely dwarf) plants with one or few stems, and comparatively large heads; some apparently biennials; pappus-scales at least pointed.

1. Pappus-scales short, not over half length of disc-corolla, not at all aristate. 2.

Pappus-scales long-pointed or aristate. 3.

2. Stature low, rarely over 20 cm.; plant hoary. (Mountains of Nevada, 2,400–2,700 m.) *H. canescens.*

Stature and appearance of *H. canescens biennis*, about 75 cm. high; pappus as in *H. canescens.* (Charleston Mountains, Nevada, 1,800–2,100 m.) *H. canescens nevadensis.*

3. A tall xerophytic plant, with much-divided leaves, with linear segments, the foliage divergent from the stem, with a tendency to curl. (Utah, N. Arizona.) *H. canescens biennis.*

Mesophytic plants, tall and upright, with large heads and comparatively coarse erect foliage. 4.

4. Basal leaves entire to bipartite; leaf-segments very broad. (Colorado.) *H. helenioides.*

Basal leaves always divided; leaf-segments narrower. 5.

5. Heads larger. (Northern California and western Nevada.) *H. Lemmoni.*
Heads smaller. (Eastern Nevada, Utah and northern Arizona).
H. Lemmoni Greenei.

Subgenus **Picradenidia** subg. nov.

Cauline leaves elongate-oval, large, entire, pointed apically, strongly punctate; heads very large, very convex; rays large and conspicuous; inner bracts with long pointed tips; receptacle high-conical; pappus-scales long-pointed. (Southern California.) Type and only species, *H. latissima*.

Subgenus **Phileozera** (Buckley, 1862)

Annuals (rarely biennials), usually much spreading, with numerous heads; foliage and growth suggestive of *Anthemis* or *Matricaria;* inner bracts not very different from outer, not abruptly contracted apically, or copiously fringed; pappus-scales long-pointed; disc-corollas distinctly expanded at mouth.

1. Heads very large, up to 15 mm. broad (excl. rays). 2.
Heads much smaller, usually not over 8 mm. broad (excl. rays), often smaller. 3.
2. Heads rather larger; inner bracts narrow and long-pointed. (Mexican table-land.) *H. chrysanthemoides.*
Heads rather smaller; bracts broader; plant of laxer growth and olive-green foliage. (Vicinity of Yuma, Arizona.) *H. chrysanthemoides excurrens.*
3. Biennial. (Arizona.) *H. Davidsonii.*
Annual. 4.
4. Plant large and bushy, often about 45 cm. high, or more; heads (excl. rays) about 8 mm. diameter, sometimes rather less. 5.
Plant quite small, much less than 20 cm. high; heads usually smaller. 6.
5. Plant typically larger; bracts broader. (State of Chihuahua, Mexico, extreme western Texas, southern New Mexico, southern Arizona.)
H. chrysanthemoides juxta.
Plant typically smaller (about 21 cm. high); bracts narrower. (Otero Co., Colorado.) *H. chrysanthemoides Osterhoutí.*
6. Plant many-stemmed and densely leafy, about 10 cm. high, heads (excl. rays) about 8 mm. broad, rays broad. (Dog Spring, southern New Mexico.)
H. chrysanthemoides Mearnsi.
Not nearly so densely tufted, usually upright, with smaller heads. (Texas, except the extreme western part; plains of eastern New Mexico, Oklahoma, western Kansas.) *H. chrysanthemoides multiflora.*

Subgenus **Picradeniella** subg. nov.

Very small annuals, with some of the stem-leaves broad, with short lateral lobes, such leaves being unique in *Hymenoxys;* receptacle very high and narrow; pappus-scales long-pointed; rays almost undeveloped, minute. Type and only species, *H. texana.*

There is scarcely a species or variety of *Picradenia* which has not at one time or another been labeled "*Actinella Richardsoni*" or "*Picadenia Richardsoni*" by some competent botanist. It is hard to understand why this should be, since typical *H. Richardsoni* does not appear to occur in the United States, and the plants so labeled are many of them extremely different from it, even in

superficial appearance. I have even found a species of *Phileozera* labeled *Richardsoni!* Those who could make such identifications ought not to feel very indignant at the way I have "lumped" the northern races under *H. Richardsoni*, and the southern annuals under *H. chrysanthemoides*. When one compares the typical *chrysanthemoides* with typical *multiflora*, the idea of specific unity seems ridiculous to the highest degree, although in the *Anthemideae*, at least, nearly as much difference may sometimes be produced by the direct action of the environment. I confess that I cannot myself contemplate these two plants together without a strong feeling that they constitute a *reductio ad absurdum* of my classification. At the same time, when the whole series of plants is arrayed on a table so as to be directly compared, one does not know where to draw specific lines, and no good structural characters are apparent upon microscopical examination. I have tried consistently to follow the rule that species are not marked by the amount of divergence they exhibit, but by the fact of their discontinuity in nature. Species to me are like islands; sub-species are like peninsulas. A peninsula may be vastly more important and more distinct than the little island off the shores; but nevertheless it remains a peninsula, and the island, however small, is an island. Thus in the *Phileozera* series, *multiflora* and *anthemoides* are great peninsulae, and *Davidsonii* is a little island close to the latter, much nearer to it in characters than it is to the *chrysanthemoides* mainland.

I do not find any distinct evidence of the origin of species by mutation in *Hymenoxys*. On the contrary, the characters of the species are highly adaptive. Differences of environment appear to result in morphological differentiation, but when the environments are intimately connected, as they are in the north and south, not in specific segregation. When we find the plants growing on more or less isolated mountain ranges, as in New Mexico, there appears a strong tendency to form species, closely allied but definitely separated. Thus isolation brings about the *separation* of "species," without (in all probability) having anything to do with their *differentiation*. It is exactly similar to the case of mountain peaks which, submerged in the ocean, become islands, but the ocean had nothing to do with forming the peaks. Of course it

will be granted that the matter is not so simple as here pictured; but I think that the facts warrant the suggestion made, admitting various minor qualifications.

Notwithstanding the evident plasticity of the species, they are more nicely adjusted to their surroundings by true racial characters than one would at first suspect. Thus *H. Vaseyi* appears to remain in the Organ Mountains, although the rains must often wash its seeds down to the adjacent lowlands. *H. floribunda utilis* insists upon occupying quite high altitudes in central Colorado, although other *floribunda* forms (in New Mexico and Arizona) give it a precedent for going lower; and what is perhaps more curious, it has not appeared at all on the east side of the front range. Then again, *H. floribunda utilis* ceases abruptly in central Colorado, and going a little north we find abruptly beginning and very abundant the large-headed *H. Richardsoni macrantha*. Now it is difficult on the face of things to say why *macrantha* should not be common as far south as Santa Fé, and *floribunda* as far north as Wyoming.

Hymenoxys Richardsoni (Hooker)

Picradenia Richardsoni Hooker, Flora Boreali Americana, **1**: 317. *pl. 108.* 1833.

Actinella Richardsonii Nuttall, Trans. Amer. Phil. Soc. **7**: 379. 1841.

I am greatly indebted to Mr. O. F. Cook for a copy of the original description and a photograph of the plate. The description is as follows:

"*Radix* subfusiformis, lignosa, descendens, ramosa, superne divisa. *Caules* subspithamaei, erecti, rigidi, glabri, striati, superne ramosi. *Folia* 3–4 uncias longa, lineari-filiformia, *caulina* pauca; omnia pinnatifida, laciniis paucis, remotis, rarius iterum divisis, glanduloso-atque pellucido-punctatis, obscure unicostatis. *Pedunculi* terminales, uniflori. *Flos* [*i. e.* caput] majusculus. *Involucrum* hemisphaericum, impresso-punctatum, glandulosum, subpubescens; foliolis oblongis imbricatis, exterioribus inferne coadunatis. *Rachis* (seu *receptaculum*) conica, carnosa, punctata, ebracteata. *Flosculi radii* ligulati, obovato-oblongi, lutei, tubo praecipue glandulosi, apice dentibus 3 grossis; *disci* tubulosi, 5-dentati, flavi, glandulis valde amaris tecti. *Antherae* subexsertae. *Stigmata* inclusa, breviuscula, apice incrassata et hirsuta. *Achenium* oblongum,

superne latius, pilosum praecipue apicem versus. *Pappus* paleaceus, paleis 6–7, erectis, ovatis, acuminatissimis, membranaceis.

"HAB. About Carlton House, on the Saskatchawan. *Dr. Richardson.* — Allied to *Hymenoxys* of Cassini, in the nature of the pappus: but very different in the involucre and habit."

The plate shows three rather short, branched stems arising from a thick and evidently perennial root; the basal leaves numerous, with linear divisions; the rather long naked peduncles extending beyond the leaves, the heads large for the size of the plant, and not very numerous; the rays broad and conspicuous, four-nerved, and tridentate apically; the outer bracts united nearly to the middle, the inner similar to the outer, and not or hardly surpassing them; the receptacle obtuse-conical, somewhat broader than high; the achene stout and rather short, hairy; the pappus-scales long-acuminate, but not half the length of the disc-corolla.

This is a plant of the type of *Picradenia macrantha*, "*P. ligulaeflora*" and "*P. pumila.*" Comparing it with the type specimens of these three, we find characters as indicated in the table on page 470.

The roots are practically the same in all four. The foliage does not differ in any important respects, but is more wiry, and pallid, in *P. pumila.* According to the figure, the foliage of *P. Richardsoni* is also more wiry than that of *P. macrantha* or *P. ligulaeflora.* The pappus-scales in *P. ligulaeflora* are long-awned, decidedly more produced than in the others.

According to the data on the type sheets, it seems that *P. macrantha* flowers earlier than *P. ligulaeflora.* *P. pumila* occurs on "dry clayey hills" in western Wyoming. *P. ligulaeflora* on dry clayey alkaline ridges or flats on the open plains. *P. macrantha* on open stony slopes. The two extremes of this series are *P. macrantha* and *P. pumila; P. ligulaeflora* is fairly intermediate, while *P. Richardsoni* leans towards *P. macrantha.*

The above remarks are based only on the types of the four species named. When one comes to examine specimens from numerous localities, it appears impossible to maintain them as separate species, owing to the existence of various intermediates. This seems strange, considering how totally different *P. macrantha* and *P. pumila* are, and I am not certain that detailed field study might not modify the conclusions here reached; yet with the

P. Richardsoni Hook.	*P. macrantha* A. Nelson.	*P. ligulaeflora* A. Nelson.	*P. pumila* Greene.
Plant about 13 cm. high.	Plant 13 to 18 cm. high.	Plant about 13 cm. high.	Plant about 6 cm. high.
Heads large, rays shorter than in *P. macrantha*.	Heads large, rays up to 15 mm. long, very bright yellow.	Heads medium-sized, rays not so well developed as in *P. Richardsoni*, pale yellow.	Heads about as in *P. ligulaeflora*.
Peduncles evidently extended beyond the leaves.	Peduncles evidently extended beyond the leaves.	Peduncles hardly extended beyond the leaves.	Peduncles hardly extended beyond the leaves.
Outer bracts joined nearly to middle but variable.	Outer bracts variable, perhaps rather less united.	Outer bracts variable, joined to middle or only one-third.	Outer bracts joined to middle or less.
Inner bracts lanceolate, not fimbriate, gradually narrowed to tip. (Thus much as in *P. odorata!*)*	Inner bracts broad, strongly white fimbriate, suddenly narrowed to a green acuminate apex.	Inner bracts as in *P. macrantha* but the apical part shorter, and pale yellowish like the rest of the bract.	Inner bracts practically as *P. ligulaeflora*.
Achenes of disc-florets about half length of their corollas.	Achenes of disc-florets about or hardly over half length of their corollas.	Achenes of disc-florets narrower in proportion to their length, much more than half length of their corollas.	Achenes of disc-florets practically as in *P. ligulaeflora*, not greatly shorter than their corollas.
Receptacle rounded.	Receptacle rounded.	Receptacle low, rather more conical.	Receptacle more conical, or subcylindrical.
?	Hair on achenes tinged with reddish; pappus-scales white reddish at base.	Hair on achenes white; pappus-scales white, or slightly reddish at base.	Achenes reddish, but their hair white, except at base; pappus-scales white.
Pappus-scales not half length of disc-corolla.*	Pappus-scales about ⅔ length of disc-corolla.	Pappus-scales about three-fourths length of disc-corolla.	Pappus-scales hardly two-thirds length of disc-corolla.
Type from Carlton House, Saskatchewan, British America.	Type from Fort Steele, Wyoming, collected by A. Nelson, June 18, 1898.	Type from plains near Laramie Peak, Wyoming, collected by A. Nelson, Aug. 6, 1895.	Type from Rock Creek, Wyoming, collected by E. L. Greene, July 10, 1896.

material in hand I cannot satisfactorily distinguish more than one species with several races. Those who disagree with this conclusion will not feel obliged to follow the nomenclatural changes involved.

It would be possible to go to an opposite extreme, and found a large number of specific names on the various combinations of slight characters of the bracts, pappus, achenes, etc., presented by the different specimens. I should not object at all to naming races on slight characters or combinations of characters, if it were possible to prove that they possessed local constancy; but obviously,

* But see first footnote on page 472.

only field-study could determine this. Specimens collected at the same locality in Wyoming in different years show differences in the bracts, apparently due to differing meteorological conditions, most probably conditions of drought and moisture. The same causes may have something to do with the differences between specimens of *P. floribunda* collected in different years near Santa Fé, N. M. Prof. K. Pearson, in his recent experiments, has found it hard to separate the effects of different seasons from those dependent on genuine racial differentiation, except after studies extending over considerable periods of time.*

In the Rocky Mountains there often exist in close geographical proximity very different soils, differing in the amount of moisture they contain, in their texture, in their chemical constituents, or in all of these things. It remains to be shown how far these soil differences are the immediate and direct causes of differences in plants, and this can only be done by experiment. Experience suggests that in the main the apparently different plants of, *e. g.*, rocky hillsides and alkaline flats, are really specifically different in the majority of instances, and could not be artificially interchanged. This conclusion is supported by the fact that these plants are often so very different (*e. g.*, generically so) that the idea of their characters being non-hereditary does not suggest itself, and the fact that they do not spread to the contrasted environment is evident. I should, therefore, feel very well disposed to consider *P. macrantha* and *P. ligulaeflora* perfectly distinct species, were it not that I cannot exactly state with the herbarium material before me, where one leaves off and the other begins. Professor Aven Nelson, who knows them in the field, believed them to be distinct.

HYMENOXYS RICHARDSONI (Hooker) typical

The type of this species and of Hooker's genus *Picradenia* came from the most northern locality (about 53° N. Lat.) in which *Hymenoxys* has yet been found. In two particulars the figures indicate a plant differing from anything I have seen, (1) the inner bracts are not fimbriate, (2) the pales of the pappus are remarkably short, not half the length of the disc-corolla. I should be in-

* Biometrika, **2**: 145–165. 1903. In *Ficaria Ficaria*, "the influence of environment and of season are of supreme importance and screen differences due to local race."

clined to attribute these peculiarities to the carelessness of the artist (although the figures seem carefully drawn), were it not that an inscription at the corner of the plate indicates that Sir William Hooker himself made the drawings.*

Hymenoxys Richardsoni pumila (Greene)

Picradenia pumila Greene, Pittonia, **3**: 271. 1898.

Professor Aven Nelson considers this a synonym of his *P. ligulaeflora*, but Dr. Greene (in litt.) states that it has never seemed to him the same. Dr. Greene has very kindly allowed me to study his type specimens, and I think the plant should be separated from subsp. *ligulaeflora*.† The typical specimens of the two plants look very different. *P. ligulaeflora* being taller, with straight erect stems, and greener foliage, exhibiting characters usually regarded as mesophytic. *P. pumila*, on the other hand, is a genuine xerophyte, with short stems, inclined to spread outwards, and pale wiry foliage. *P. ligulaeflora*, as its author states, is a plant of the open plains in Wyoming; the type of *P. pumila* came from Wyoming, but much further west, and as I recognize the plant it is alpine and northern. The following are referred to *H. Richardsoni pumila*:

WYOMING. — Rock Creek, *Greene*.

COLORADO. — North Park, Larimer Co., July 13, 1896, *G. E. Osterhout*. This has the foliage and aspect of subsp. *pumila*, but is taller (about 9 cm.); receptacle quite high, higher than broad, rounded at end; achenes very red; pales of pappus about ⅔ length of disc-corollas.

* I have now examined the type material of *Picradenia Richardsoni* at Kew; it is abundant (covering two sheets) and in excellent condition. To my surprise the peculiarities noticed in the original figure do not exist. The inner and outer bracts are not alike; the inner are strongly fimbriate as usual in the group, the outer are united quite high up. The pappus-scales are ferruginous, and are long-pointed, reaching far beyond the middle of the corollas. Large, well-developed heads are as much as 31 mm. across, including the rays. In view of all this, I do not think it is practicable to separate *macrantha* from *Richardsoni*.

† Dr. Greene says the type is from Western Wyoming. Professor Nelson writes, "the type of *P. pumila* was the Laramie Plains near Rock Creek, and not far from the type locality of *P. ligulaeflora*." Are there two Rock Creeks? A specimen which Professor Nelson had labeled *pumila* is not that form.

UTAH. — Mt. Ellen, Henry Mts., Garfield Co., Utah, 10,000 ft., July 25, 1894, *M. E. Jones:* top of Salina Pass, 8,200 ft., June 16, 1894, *M. E. Jones.* The Salina Pass material is poor; that from Mt. Ellen is good, and looks very like some specimens of *H. Richardsoni ligulaeflora*, especially those from Montana. However, it has the pale foliage of *pumila*, and the comparatively short pappus-scales, hardly ⅔ length of disc-corolla. The achenes are of the long type.

ASSINIBOIA. — Medicine Hat, June 2, 1894, *John Macoun;* Cypress Hills, August, 1880, *John Macoun;* Wood Mountain, June 6, 1895, *John Macoun.* This was confidently expected to be true *H. Richardsoni*, the material coming from localities about 200 miles (or some less?) south of Carlton House. It resembles *H. Richardsoni* in the conspicuous flowers, with large orange rays, and the inner bracts, though fimbriate, do gradually taper to the apex, as in the figure of *P. Richardsoni.* The foliage much resembles that of subsp. *pumila*, and the stature is about the same, though the largest plants are as much as 10 cm. tall. The Wood Mountain plant is more dwarfed than the others (height 6 to 8 cm.), and has the achenes short (a *Richardsoni*-character), their hair shining pale ferruginous; the pappus-scales are ferruginous basally, and have long linear awns, the whole ¾ length of disc-corolla, as in subsp. *ligulaeflora.* The Medicine Hat plant, with the same conspicuous orange-rayed heads, has the achenes fairly long (considerably over half length of disc-corolla), their hair strongly ferruginous; the pappus-scales are light ferruginous, darker at base, ⅓ length of corolla, the oval portion very large, the apical portion linear and about ⅓ length of the whole. In this plant the achenes are much longer than in true *H. Richardsoni* The Cypress Hills material is poor; the achenes are long, as in subsp. *ligulaeflora*, the pappus-scales also very long; hair of achenes ferruginous.

It will be apparent from the above that the Assiniboia plants are variable and are not exactly *H. Richardsoni* or subsp. *pumila.* Assuming the figures of *P. Richardsoni* to be correct, I cannot refer them there, and on the whole they go best here.

It is difficult to decide how to indicate such puzzling forms in the nomenclature. In the present paper I shall use the term

variety as meaning something which appears to possess distinctive racial characters, and yet is not thoroughly established (in human knowledge, not in fact!) as a subspecies. As we know more, some such "varieties" will be reduced to forms, mutations or synonyms, while others will rank as subspecies or even valid species.

Following this plan, the Assiniboia plant (taking the Wood Mountain plant as the type) may stand as var. **Macouni.** The type sheet is in the herbarium of Dr. E. L. Greene. The others are in herb. Mo. Bot. Garden and U. S. Nat. Museum.

Hymenoxys Richardsoni ligulaeflora (A. Nelson)

Hymenopappus ligulaeflorus A. Nelson, Bull. Wyoming Exper. Sta. 28: 135. 1896.

Originally described as *Hymenopappus ligulaeflorus*, this was later transferred to *Picradenia* by its author (*cf.* Bull. Torrey Club, **25**: 378. 1898). Professor Nelson has very kindly allowed me to study the type specimens. The characters of this plant have been set forth above, in the table on page 470; the following material is referred to it:

WYOMING. — Plains near Laramie Peak, *A. Nelson;* North Vermillion Creek, Sweetwater Co., July 17, 1897, *A. Nelson;* Steamboat Lake, July 2, 1896, *G. E. Osterhout;* rolling plains between Sheridan and Buffalo, 3,500–5,000 feet, June 15 to July 15, 1900, *Frank Tweedy;* on clay, saline flats, Antelope Basin, Albany Co., July 8, 1900, *A. Nelson.* These localities are in Albany and Sweetwater counties, southern central Wyoming, except the one between Sheridan and Buffalo, which is in north central Wyoming. The North Vermillion Creek plant has the long achenes, reddish like subspecies *pumila;* pappus awns hardly so long as in type; heads larger than typical. The Steamboat Lake plant agrees with the type. The Tweedy plant is variable in height, 8 to 17 cm., the smaller ones looking like subspecies *pumila;* the achenes are ferruginous, shorter than in the type; foliage rather approaching subspecies *pumila;* inner bracts and pappus-scales as in subspecies *ligulaeflora.* The Antelope Basin plant is like the type, but the rays are more orange; achenes long, their hair silvery white; pappus white, about normal; inner bracts green-tipped.

MONTANA. — Helena, July 27, 1887, *R. S. Williams.* Appearance of subspecies *ligulaeflora;* bracts agree; achenes broad but long, with copious ferruginous hair; pappus-scales ferruginous at base, fairly long-awned; the achene is more like that of the Assiniboia plant than that of typical subspecies *ligulaeflora.* Also collected at Helena by *Rev. F. D. Kelsey,* July 4, 1888.

COLORADO. — Rocky Mts., lat. 40–41°, 1868, *Geo. Vasey.* Rather tall.

It will be observed that it is in northern Wyoming and Montana that subspecies *ligulaeflora* passes into subspecies *pumila,* whereas in southern Wyoming and northern Colorado it passes into subspecies *macrantha.* One of the Helena sheets (*Kelsey*) shows conspicuous rays which seem to have been orange, recalling the plant of Assiniboia. The plant, however, is 15 cm. high.

Hymenoxys Richardsoni macrantha (A. Nelson)

Picradenia macrantha A. Nelson, Bot. Gaz. **28**: 130. 1899.

Professor Nelson says, allied to *P. ligulaeflora,* "from which its larger size, conspicuous rays, longer peduncles, fewer and less resinous heads serve to separate it."

The following material is referred to subspecies *macrantha:*

WYOMING. — Fort Steele, *A. Nelson;* clayey draws, Cooper Lake, Albany Co., June 17, 1901, *Leslie N. Goodding;* Centennial Hills, August 19, 1895, *A. Nelson.**

These localities are all in the southern part of the state. The Centennial Hills plant may be called var. **Nelsoni;** it is remarkable for its gigantic heads, up to 2 cm. across, exclusive of the rays, which appear to have been very pale. Its achenes are broad and reddish, and the shining white pappus-scales are barely two-thirds the length of the disc-corolla. It is in the herbarium of the University of Wyoming. The Cooper Lake plant is labeled *P. ligulaeflora,* and has the stature of that plant, but the large flowers, with conspicuous orange rays, are precisely those of subspecies *macrantha.* The inner bracts are green-tipped; peduncles hardly so long as in typical *macrantha;* achenes rather short;

* Professor Nelson writes me that the soil at the Centennial Hills is mostly gravelly and free from alkali, while that at Fort Steele where subspecies *macrantha* occurs is a heavy saline clay.

hair of achenes and pappus white; pappus only moderately long. It is this material, and that from Como, Colorado, that seem to me to break down the distinctions between subspecies *macrantha* and *ligulaeflora*.

COLORADO. — Central Colorado, as far south as Park and Lake Counties; further south it is replaced by *H. floribunda*. Como and near Como, Park Co., 9,800 feet, July 23, 1897, *C. S. Crandall;* Twin Lakes, August 7, 1873, *J. M. Coulter;* South Park, 8,500 feet, September 17, 1878, *M. E. Jones;* South Park, July, 1873, *John Wolf;* lat. 39–41°, alpine and sub-alpine, *Hall & Harbour;* South Park, 1891, *Alida Lansing*. As it goes southward, the plant reaches quite high altitudes. One sheet from Como is said to have come from a meadow, showing that the mesophytic appearance of the plant is not wholly illusory. The altitude of this meadow is given as 9,775 feet; the date, August 3, 1895. This appears to be very good *macrantha*, as to general appearance, achenes and pappus; but the sheet from near Como, certainly not a different plant in any important respect, is labelled *P. ligulaeflora* by Professor Nelson. This has the heads nearly as large as in subspecies *macrantha*, but the achenes are of the long type; hair of achenes silvery-white; pappus-scales white, ferruginous at base. The habitat is very different from that normal to subspecies *ligulaeflora*. One sheet of the Hall and Harbour material (herb. Cal. Acad. Sci.) has the heads (excl. rays) only 9 to 10 mm. broad, and is fairly intermediate between *macrantha* and *ligulaeflora*.

The Twin Lakes material has all the appearance of subsp. *macrantha*; but the achenes, though broad as in *macrantha*, are long enough for *ligulaeflora*; hair of achenes ferruginous; pappus-scales rather short, as in *macrantha*. Another sheet from Twin Lakes is marked July 22, and is just coming into flower. The Wolf material from South Park has the achenes short, with deep ferruginous hairs; pappus-scales very strongly ferruginous basally, not very greatly over half length of corolla.

UTAH.— Emery, 7000 ft., June 16, 1894, *M. E. Jones*; near Emery, on clay, June 16, 1894, 7000 ft., *M. E. Jones*; Cannonville, 6000 ft., May 28, 1894, *M. E. Jones*. These plants, from southern Utah, are not typical, the flowers being on the average smaller (heads excluding rays about 10 mm. diam.— 12 to 16 in *macran-*

tha), with pale yellowish, coriaceous, well-keeled bracts, the inner not at all green-tipped; the foliage paler, though the leaf segments are as broad and flat as they are in true *macrantha;* the rays evidently shorter, and apparently more orange-tinted. The achenes are broad, of moderate length, with copious pale ferruginous hairs; the pappus-scales are fairly long, dilute ferruginous, darker basally. The receptacle is quite small. This plant may be designated var. **Utahensis,** the Emery sheet in the National Museum (234968) being taken as typical. Compared with *H. floribunda*, the plant is not so tall, and the heads are larger; the leaves also are longer, and their segments broader. Two other sheets must also be referred to var. *Utahensis*, as follows: Capitol Wash, 7000 ft., evidently in red soil, July 19, 1894, *M. E. Jones.* A plant with longer slender stems, the longest about 25 cm.; foliage pale; achenes more slender, white-haired. This tends towards *floribunda.* Rabbit Valley, 6800 ft., July 23, 1875, *Lester F. Ward.* About 15 cm. high, very leafy at base, the leaf-segments narrower; heads (excluding rays) about 10 to 13 mm. diameter; achenes broad, with ferruginous hair. All these Utah plants appear to be essentially of one type, which in its more extreme forms (*e. g.*, that from Capitol Wash) does not even suggest subsp. *macrantha.*

A good specimen of var. *Utahensis* from near Emery is in the herbarium of the California Academy of Sciences (33875).

Hymenoxys Lemmoni (Greene)

Picradenia Lemmoni Greene, Pittonia, **3**: 272. 1898.

The original description is as follows:

"Evidently perennial, glabrous and strongly punctate, the rather slender stems 1½ feet high, not rosulately nor densely leafy at base; the lowest leaves on rather coarse elongated erect petioles 5 or 6 inches long, the blade only 2 inches, pinnately cut into about 3 pairs of divaricate linear lobes: heads middle-sized in a corymbose cyme; bracts of the involucre subequal, the outer series ovate-lanceolate, the inner oblong, obtuse. Mountains of California, probably northward; collected only by J. G. Lemmon, and by Dr. Gray erroneously referred to his *A. biennis.*"

This plant is easily recognized by its tall upright growth, with

large heads and conspicuous rays, and comparatively coarse erect foliage. It has the characters of a mesophyte, and could be derived from the type of *P. macrantha* by the elongation and reduction in number of the stems. The heads (excluding the rays) are about 12 to 17 mm. diameter. The roots are stout (up to 10 mm. diam.), but I do not feel perfectly sure that the plant is more than biennial. The petioles of the basal leaves seem usually to be not over 7.5 cm. long. The species appears to be common in the region about Mt. Shasta, northern California (where it is the only *Picradenia*), and it extends practically unaltered into western Nevada. Further east it is replaced by a distinct subspecies. Its characters separate it sharply from the xerophytic *H. canescens biennis*. Miss Eastwood had recognized it as a new species before the description of *P. Lemmoni* was published. The following material is referred to *H. Lemmoni:*

CALIFORNIA.— North side of Mt. Shasta, Siskiyou Co., 5000–9000 ft., June 11–16, 1897, *H. E. Brown*; Sierra Valley, June, 1879, *J. G. Lemmon;* Sierra Nevada Mts., 1875, *J. G. Lemmon;* near Edgwood, Siskiyou Co., July 28–21, 1892, *Dr. E. Palmer;* on Shasta River, 14 July, 1876, *Edw. L. Greene;* near Yreka, Siskiyou Co., July 14, 1876, *Edw. L. Greene;* journey from Willametta to California, *Capt. Wilkes Expl. Exped.*

NEVADA.— Star valley, July 21, 1876, *Edw. L. Greene.*

The Mt. Shasta plant collected by H. E. Brown is about 3.5 dm. high, perfectly glabrous, the stem pale and shining, the leaves strongly punctate. The lowest leaves are on rather coarse elongated erect petioles 6 to 7 cm. long, the blade 3 to 5.5 cm., pinnately cut into lobes which are about 2 mm. broad and six or seven in number. The heads are ten or eleven in number, close together, 11 to 14 mm. diameter (excluding rays), rays lemon yellow and about 10 mm. long. Bracts pale yellowish green; outer bracts about 10 in number, united beyond the middle, basal two-thirds strongly thickened and subcarinate; inner bracts broad, hardly surpassing outer, pointed-tipped, with more or less fimbriate sides. Pappus pales a little over half length of disc-corolla, long-acuminate but not aristate, pale ferruginous, as also is the hair of the achenes. The Sierra Valley plant has the outer bracts deeply divided, carinate, blunt, without dark green tips; achene-hairs

ferruginous; pappus-pales long-pointed, white, ferruginous at extreme base (like the Star Valley plant). Another Sierra Valley sheet (hb. Mo. Bot. Garden) is clearly the same thing, but it has the pappus-pales wholly ferruginous, long-pointed but hardly half length of disc-corolla; leaf-segments narrower; inner bracts often bifid at end. The plant from near Edgwood has the leaf-segments narrower than usual; outer bracts narrow; achene-hairs ferruginous; pappus-pales aristate, white with a ferruginous tinge. The Shasta River plant has the achenes and pappus like the last. The plant from near Yreka has the achene-hairs deep ferruginous; pappus ferruginous. The Star Valley plant (which Dr. Greene in litt. thought might prove distinct) has the appearance of the California ones, with large heads and clear yellow rays; the outer bracts are narrow and deeply divided, 13 in number; hair of achenes quite bright ferruginous; pappus-pales strongly contrasting, pure shining white except the extreme base, which is ferruginous. The plant grows to a height of 3 to 4 dm.

All the above plants seem to me essentially the same. They agree with *H. Richardsoni* in the short pappus-pales, but the much greater height and mesophytic habit are distinctive. I cannot understand how anyone, after a careful study, can doubt the validity of *H. Lemmoni* as a species.

Hymenoxys Lemmoni Greenei subsp. nov.

Picradenia biennis Greene, Pittonia, **3**: 272, in part. 1898. (Not *Actinella biennis* Gray.)

This plant is similar to the true *H. Lemmoni*, but the heads are uniformly smaller. The basal leaves, as in *H. Lemmoni*, are always divided; the plant mentioned by Dr. Greene, with simple and linear basal leaves, is to be separated. Dr. Greene says, "probably only a winter annual," but I think the plant is biennial.

I take as typical of this subspecies Palmer's *261*, collected in 1877, "So. Utah, N. Ariz., etc.," in herb. Mo. Botanical Garden. There is a single reddish stem, smooth and striate; foliage abundant and erect, like true *H. Lemmoni;* stem-leaves much as in true *H. Lemmoni*, but broader, the foliage intermediate in breadth between *H. Lemmoni* and *H. helenioides;* basal leaves about 11 cm. long, pinnately divided, with lobes 2–3 mm. broad; heads

(excl. rays) 10–13 mm. diameter, averaging smaller than *H. Lemmoni* or *H. helenioides;* rays well developed; outer bracts divided to near base, 9 in number, broad basally, rapidly narrowing to an obtuse point; involucre not woolly, except some loose pubescence on margins of bracts; inner bracts about as long as outer, very broad, with short points, fimbriate; hair of achenes and pappus ferruginous, pappus-pales long-awned. According to Greene, Palmer's *261* is from Rock Creek, Utah. Other material referred here is as follows:

UTAH. — Deep Creek, July 28, 1891, *Marcus E. Jones.* In herb. Mo. Bot. Garden and herb. U. S. Nat. Mus., the two sheets exactly similar. Foliage not quite so broad, pale yellowish-green; two stems from one root; outer bracts about eleven, not rapidly narrowing.

NEVADA. — Huntingdon Valley (Elko Co., about 80 miles W. of Utah line), 6,000 ft., Aug., 1868, *Sereno Watson.* In herb. U. S. Nat. Mus. About 4 dm. tall; outer bracts deeply divided, not at all woolly; pappus-scales long-pointed, over half length of corolla, ferruginous.

ARIZONA. — "Northern Arizona," *Mrs. Thompson,* 1872. In herb. U. S. Nat. Mus. Pappus and hair of achenes ferruginous; pappus-scales very long-awned, in some cases not far short of length of disc-corollas; much woolly hair between outer bracts; upper part of stems hairy; foliage narrower than typical. The outer bracts are numerous, and separated far down. This is perhaps a distinct variety.

Hymenoxys subintegra sp. nov.

An apparently perennial and xerophytic plant, about 2 dm. high, with a stout base. Foliage pale, canescent because minutely hirsute, similar in type to that of *H. Lemmoni Greenei,* but the basal leaves broad-linear and entire; cauline leaves frequently with a couple of lateral lobes. Breadth of leaves or their divisions up to 3 mm. Root about 7 mm. broad; stems three, not very stout; flower-heads about 17, at various heights (inflorescence not at all flat-topped as in the *macrantha* forms, more spreading than in the *Lemmoni* forms); size of head moderate, 10–13 mm. diam. excluding rays; rays deep yellow (not orange as in *H. helenioides*);

stems very slightly reddened; outer bracts 12, deeply divided, basally thickened, apical part dark green and very woolly; inner bracts not or barely surpassing outer; hair of achenes, and pappus-scales, shining but slightly sordid white; pappus-scales extremely large and elongate, ending in a linear tip which is nearly equal to the disc-corolla. (PLATE 22, FIGURE 1.)

Nagle's Ranch, Arizona, 7,600 ft., Sept. 13, 1894, *Marcus E. Jones*. U. S. Nat. Mus. *234966*.

I have tried over and over again to convince myself that this plant is a subspecies of *H. Lemmoni*, but there seems nothing to do but to treat it as distinct. It may very well be regarded as a derivative of *H. Greenei*, which has become adapted to a xerophytic existence. The character of the pappus at once separates it from *H. Cooperi*.

Hymenoxys helenioides (Rydberg)

Picradenia helenioides Rydberg, Bull. Torrey Club, **28**: 21. 1901.

Apparently biennial; similar in type of foliage and mode of growth to *H. Lemmoni* (not at all similar to *H. canescens biennis!*); rather taller, up to 5 dm.; foliage pale yellowish-green; leaf-segments much broader, of basal leaves up to 9 mm. broad, of stem-leaves to nearly 4; lowest leaves entire to bipartite, up to 18 cm. long; stem strongly striate, not reddened; involucre beset with white woolly hairs; outer bracts narrow and divided almost to base; disc-corollas only hairy at top; rays orange; hair of achenes, and pappus-scales, pale ferruginous; pappus-scales long-acuminate, practically as in *H. Lemmoni*, mostly much more than half length of disc-corolla. The receptacle is high-conical, rounded at apex; inner bracts very long fimbriate; outer bracts far exceeding inner, narrow, green, straight-sided.

I have seen only one sheet, from Sangre de Cristo Creek, Colorado, 7,200–8,100 ft., July 2, 1900, *Rydberg & Vreeland*, in hb. Univ. of Wyoming. This is from the original lot. The species is allied to *H. Lemmoni*, but as far as present evidence goes is quite distinct. It seems remarkable that such a striking plant should so long have escaped discovery. The plant is evidently a mesophyte.

Hymenoxys canescens biennis (Gray)

Actinella biennis Gray, Proc. Am. Acad. **13**: 373. 1878.
Picradenia biennis Greene, Pittonia, **3**: 272 (excl. descr.).

A tall xerophytic plant; base of stems not woolly, but with very numerous, much divided leaves, with linear segments. The foliage is not erect, as it is in *A. Lemmoni*, but divergent from the stem, with a strong tendency to curl, the whole appearance being very distinctive. The following particulars are based on a sheet (U. S. Nat. Mus. *27487*), representing the original lot, Dr. Palmer's *260*, collected in 1877 at Mokiak Pass, Arizona.*

Root large, 8 mm. diameter; a single stout (about 7 mm. diameter at base) strongly reddened main stem, profusely branched from the base upwards, the whole plant about 5.5 dm. high, with over 40 heads; leaves strongly punctate, practically glabrous; basal leaves very numerous, 6 to 8 cm. long, the divisions linear, not over 1.5 mm. wide; stem-leaves 3 to 5 cm. long, the divisions about 1.5 mm. broad: heads (excluding rays) about 15 mm. broad; rays deep ferruginous (probably originally yellow), large and conspicuous, 20 mm. long and about 6 broad; outer bracts 14, strongly punctate, narrow, pointed, with straight sides, divided

* I am greatly indebted to Dr. J. M. Greenman for determining the true type of *A. biennis*. He writes (*litt.* Jan. 25, 1904) as follows:

"In looking up the original specimens on which *Actinella biennis*, Gray, Proc. Am. Acad., xiii, 373, was based * * * I find that which seems to me to be a most unfortunate circumstance, namely: there are under the name *Actinella biennis* apparently two species. The label for one of these is in the handwriting of Dr. Gray, and the locality given is 'Mokiak Pass, S. E. of St. George, Arizona,' and this label also bears the original number of Palmer, No. 260. The second plant bears a label in the handwriting of Dr. Watson, and the locality given is, 'Mokiak Pass, N. W. Arizona.' Although this second plant was passed upon by Dr. Gray in his work for the Synoptical Flora, I should assume the other must be the one to regard as the type of the species *A. biennis*, as it bears the original label in Dr. Gray's own handwriting, and the specimen has the large rays, and moreover is the one Dr. Gray had in mind when writing the description for publication.

"The differences between the two specimens under No. 260 of Palmer, as I see them, are as follows:

1. Stem suberect, much branched, 5 to 6 dm. high; heads large, including the rays 3.5 to 6 cm. in diameter; involucre biseriate; bracts more or less acuminate.
2. Stem erect, less branched than the preceding, about 3.5 dm. high; heads including the rays 3 cm. or less in diameter; involucre biseriate; bracts shorter than in the preceding, and of essentially the same length, the inner obtuse or subtruncate."

Of the above plants, No. 1 manifestly agrees with *U. S. N. M. 27487*.

nearly to base; inner bracts very broad, strongly glandular, with green subulate tips which extend beyond outer; disc-corollas densely pubescent; pappus-scales ferruginous, subulate-tipped, about half length of disc-corolla; hairs of achenes ferruginous.

In the herbarium of the Missouri Botanical Garden is another sheet bearing Palmer's number *260*. On it are two specimens; one only in bud and doubtful, the other in good flower and plainly *H. canescens biennis*. It is a smaller plant than that described above, the stem not branched until about 17 cm. from base, and there are only 14 heads. The outer bracts vary from broad to narrow on the same head. Still a third sheet of Palmer's *260* comes from the Redfield herbarium, now belonging to the Missouri Botanical Garden. This plant has a single stout reddened stem, branching about 4 dm. from base, with about 20 heads. The leaves are narrower than in the plant described as typical, and the stem is a little more scurfy. The heads agree with subsp. *biennis;* the outer bracts are 10, perhaps varying to more.

So far as I can see, all the above are one species; I presume the last described plant came from dryer ground than the type. At Mesilla Park, N. M., I have seen just the same sort of differences in the cruciferous genus *Sophia*, the specimens having single strict little-branched stems coming from higher, dryer ground.

Although *H. canescens biennis* was described from Arizona, it appears to be most abundant in Utah.

The following Utah material belongs here:

1. Pine Valley, 1874, *Dr. C. C. Parry*. Single stem about 4 dm. high, branching about one dm. from top, with three heads on long naked peduncles; foliage pale green, slightly scurfy, strongly punctate, the leaf-segments very narrow, not over one mm. wide, upper part of stem with only short inconspicuous leaves. Heads just like typical subsp. *biennis*, bracts similar but more hairy, inner bracts sometimes bifid-tipped; awns of pappus rather longer than in type, surpassing middle of disc-corolla. Another form of especially dry ground, apparently.

2. Silver Reef, 3,500 ft., May 4, 1894, *M. E. Jones*. Only in bud; very narrow linear leaf-segments; 12 outer bracts; stems several, four slender and coequal, all strongly reddish; root 7

mm. diameter. The manner of growth may result from the early destruction of the main axis by some animal.

3. Cañon above Richfield, 5,200 feet, June 5, 1875, *Lester F. Ward.* Only about 4 dm. high, with one to three new stems, but remains of the old stem of the year before. Pappus and achene-hairs ferruginous.

4. On grade south of Rockville, 4,500 feet, May 19, 1894, *M. E. Jones.* Single stems hardly 4 dm. high (one reddish, the other green), slightly lanulose at base, branching 1 dm. or less from top, with about six heads, averaging smaller than in the type, though some are as large; outer bracts 9 or 10, broad; inner very broad, strongly fimbriate, without produced tips. Pappus-scales and achene-hairs very pale, hardly ferruginous at all.

5. Near Rockville, 5,000 feet in gravel, May 19, 1894, *M. E. Jones.* Achenes and pappus more reddened than in the last.

Hymenoxys canescens nevadensis var. nov.

With the stature and appearance of *H. canescens biennis*, and the pappus of *H. canescens.* The type is from the Charleston Mts., Nevada, alt. 6–7,000 feet, 1898, *C. A. Purpus*, in herb. Calif. Acad. Sciences. It is about 75 cm. high, with a red stem, and looks exactly like subsp. *biennis;* outer bracts long, numerous and narrow; bristles of achenes bifid at tips; pappus-scales colorless, faintly stained with reddish-orange toward the base, their shape oval, more or less pointed, less than half length of disc-corolla. The lower part of the disc-corollas is densely covered with stout jointed hairs.

Hymenoxys canescens (Eaton)

Actinella Richardsoni var. *canescens* D. C. Eaton, Bot. King Exp. 175. 1871.

Picradenia canescens Greene, Pittonia, **3**: 271. 1898.

H. canescens and *H. canescens biennis* might be considered distinct species, were it not that the var. *nevadensis* combines the characters of the two. Including *biennis* and *canescens* in the same specific category, it is natural to think of *biennis* — a plant better developed and apparently more common than the other — as the typical form of species, and the treatment by Gray in the Synoptical

Flora has already accustomed us to this way of regarding the matter. I have accordingly placed *biennis* at the head of the *canescens* combination, although the requirements of priority, as I understand them, oblige us to write *H. canescens* and *H. canescens biennis*. In Dr. Greene's treatment of *Picradenia*, *P. canescens* is placed far from *P. biennis*, but it appears that Dr. Greene did not know the real *P. biennis*.

The essential characters of the true *H. canescens* are as follows: Stature small, height usually from 8 to 18 cm.; large heads like *biennis*, 15 mm. broad excluding rays; rays about as in *biennis*, but hardly so large as in the type of that subspecies; plant decidedly hoary, but hardly more so than Jones' *biennis* from grade south of Rockville; bracts about as in subsp. *biennis*, inner not or hardly surpassing outer; pappus-scales short, hardly half length of disc-corolla, broad, pointed but not at all aristate; habitat at comparatively high altitudes in Nevada. The stems are one or several, not especially slender, reddish. The plant may be perennial, but if so, so is subsp. *biennis*.

I have seen *H. canescens* from only two localities:

1. E. Humboldt mts., Nevada, 9,000 ft., Aug. 1868, *Sereno Watson*. Pappus-scales and hair of achenes entirely ferruginous; leaf-segments a little broader than in the Mt. Gabb plant; basal part of disc-corollas glandular.

2. Rocky slopes, Mt. Gabb, Palmetto R., Nevada, 8,000–9,000 ft., May–Oct., 1898, *C. A. Purpus*. One stem is 21 cm. tall. Pappus-scales white, varying to ferruginous in same head; sometimes about the basal half ferruginous, the rest yellowish-white. These plants are more hoary than those collected by Watson.

Hymenoxys floribunda (Gray)

Actinella Richardsonii var. *floribunda* Gray, Pl. Fendl. 101. 1849.

Picradenia floribunda Greene, Pittonia, **3**: 272. 1898.

Described originally from "around Santa Fé," New Mexico. Heller and Greene have considered it a valid species, and I cannot doubt the correctness of this opinion. It maintains its characters where I have seen it in New Mexico, covering, or rather dotting over, many acres of ground; and the tons of the Colorado plant

which have been gathered for the extraction of rubber show it to be no less uniform near the northern limit of its range. This refers of course to the gross characters; there is much variation in small details. Dr. Greene thus characterizes *P. floribunda:* "Taller and more slender than *P. Richardsonii*, the wool at base of stem more silky; stems repeatedly branched; heads many times more numerous, of less than half the size, forming a broad flat-topped inflorescence; paleae of the pappus lanceolate, some slenderly acuminate, others not so."

The distribution of the species includes the southern half of Colorado, at comparatively high altitudes on the west side of the front range; northern New Mexico, as far east as Raton, and the region about San Francisco Mountain, Arizona. The characters of the forms of *H. floribunda*, and of the allied *H. Earlei*, may be compared as shown in the table on the opposite page.

H. Earlei, by its rather peculiar appearance and especially the cut of its foliage, appears to be a valid species. The other three are unquestionably races of one species (*H. floribunda*). The original description of **H. floribunda utilis** (PLATE 20) under the name *Picradenia floribunda utilis* (Bull. Colo. College Museum, No. 1, December 11, 1903) is as follows:

"Similar in appearance and mode of growth to *P. floribunda* (a topo-type collected by Heller at Santa Fé, N. M., compared) but easily distinguished by the pale yellowish, broad and subovate outer bracts, with strongly concave outer margins, and the back conspicuously keeled; these bracts are united about to the middle. (In *P. floribunda* these bracts are greener, long and pointed, with straight sides, and not united quite so far as the middle). The disc-corollas have a rusty-red ring in the throat, which appears to be absent in *floribunda*. Rays narrower, about 2 mm. in diameter. As far as the specimens seen go, the basal part of the stems is much more robust in *utilis* than *floribunda*.

"Compared with *P. macrantha* and *P. ligulaeflora*, the rubber plant differs conspicuously in its taller stature and smaller flowers. It is also readily distinguished from *P. Davidsoni* and the other described species of the genus. In *P. Davidsoni* (cotype examined) the outer bracts are narrower and shorter than the inner, and the inner are much more pointed than those of *utilis*. The disc-corollas of *Davidsoni* are considerably broader at the top than those of *utilis*. The length of the disc-corollas in *Davidsoni* is 3½ mm., in *utilis* and *floribunda* 4, in *ligulaeflora* 5. In *P. ligulaeflora* and

H. floribunda type.	*H. floribunda utilis.*	*H. floribunda arizonica*	*H. Earlei.*
Height of well-developed plant 30 cm.	Height of well-developed plant 26 cm.	Height of well-developed plant 25 cm.	Height of well-developed plant 32 cm.
Lower stem-leaves about 55 mm. long, their divisions very narrow, 1 mm. broad or less.	Foliage essentially as in *floribunda* type.	Foliage essentially as in *floribunda* type.	Lower stem-leaves about 125 mm. long; their segments much broader, up to 2.5 mm.
Stems numerous, not very woolly at base; the bases of the old leaves ferruginous.	Stems very numerous, very woolly at base; the bases of the old leaves pallid.	Stems several, not very woolly at base; the bases of the old leaves pallid.	Stems fewer, scarcely at all woolly at base; base of stems reddened, which is not the case in the other three.
Heads (excl. rays) about 7 mm. diam.	Heads (excl. rays) about 6 mm. diam.	Heads (excl. rays) about 8 mm. diam.	Heads (excl. rays) about 7 mm. diam., flatter than the others, except perhaps *arizonica*.
Bracts pale, outer bracts more resinous than in *utilis*, and not quite so much united.	Bracts pale yellowish; outer bracts united far up.	Bracts about as in *floribunda* type.	Bracts formed about as in *floribunda*, but outer bracts conspicuously tipped with dark green.
Pappus and achene-hairs deep ferruginous.	Pappus and achene-hairs shining silvery white.	Pappus ferruginous at base, the rest whitish; achene-hairs pale ferruginous.	Pappus and achene-hairs shining ferruginous, the pappus very dark. Achenes short.
Pappus-scales long-pointed (aristate) about $\frac{2}{3}$ length of disc-corolla.	Pappus-scales fairly long-pointed, but not quite so long as in typical *floribunda*.	Pappus-scales broad, shorter-pointed.	Pappus-scales broad, short-pointed, as in *arizonica*.
Rays yellow.	Rays yellow.	Rays rather light orange.	Rays orange.
Type from vicinity of Santa Fé, N. M., 7000 ft.	Type from vicinity of Buena Vista, Colo., 8000 ft.	Type from near Flagstaff, Ariz., 7000 ft., *MacDougal*.	Type from Mancos, Colo.

macrantha the receptacle is hemispherical and somewhat fimbrillose, these species having in part the characters of *Gaillardia;* in *floribunda* and *utilis* the receptacle is conical and bare."

When I published this description, I was half inclined to treat *utilis* as a species, and did not in the least doubt that it should have at all events subspecific rank. Further studies, however, have shown that the characters of the bracts and the color of the pappus are not to be relied upon to the extent I had supposed; and moreover, the real type of *H. floribunda*, Fendler's plant, has the bracts nearly as in *utilis*. The characters of *utilis* are therefore largely evanescent, and until further studies can be made, especially

in the field, it will be best to treat it as a variety; *i. e.*, as representing a tendency or type of uncertain taxonomic rank.

H. floribunda arizonica, here introduced as new, may also be treated as a variety. It has the appearance of *H. floribunda*, but it is characteristic of all the material from the region about San Francisco Mountain that the pappus-scales are abbreviated. It may be, possibly, that the abbreviation of the pappus tends to prevent the seeds from travelling so far as they otherwise would, a character which might be of service to plants growing on elevated ground surrounded by desert.

Here and there, wherever it occurs, *H. floribunda* seems to exhibit occasional plants of low stature, say 10 to 15 cm. high. These are probably the result of growth in very dry spots, or perhaps in some instances due to early destruction of the growing axis by animals. Such plants must not be confused with *H. Richardsoni macrantha* and the other *Richardsoni* types; they have essentially the characters of *H. floribunda*, — the same flowers, the same spreading foliage, etc. A rather extreme example is from Galisteo, N. M., collected by *Dr. J. M. Bigelow*, on the Whipple Survey in 1853–4. (U. S. Nat. Mus. *27458*.)

It is a singular thing that the *utilis* form in Colorado seems to grow always at quite high altitudes, while the *floribunda* proper in New Mexico grows lower down, notwithstanding the lower latitude.

The following material is referred to *H. floribunda* sens. lat.: COLORADO. — 1. Buena Vista, 1903, *F. R. Marsh.* Type of *H. floribunda utilis.*

2. Buena Vista, gravelly soil, 8,000 ft., July 27, 1892, *C. S. Sheldon.* Agrees with subsp. *utilis* as to bracts, etc., but achene-hairs ferruginous.

3. Marshall Pass, 10,000 ft., August 20, *C. F. Baker.* Genuine *H. floribunda utilis*, with white achene-hairs, etc. Dr. Greene had identified this as *H. Richardsoni.*

4. Gunnison, 7,680 ft., July 17, *C. F. Baker.* Just like the last, with silvery-white achene-hairs; typical subsp. *utilis.*

5. Huerfano, August 1867, *Dr. Parry.* Rather large heads; pappus-scales ferruginous, very low-awned; achene-hairs ferruginous. This is not subsp. *utilis.* Very similar is a doubtful plant,

more approaching *H. Richardsoni macrantha*, from South Park (*G. Engelmann*, August 24, 1881); this has the pappus-scales not so long-aristate. Better material is needed of these plants.

6. Wet Mountain Valley, July 25, 1872, *John H. Redfield.* Dark red achene-hairs and pappus-scales, which are quite long-awned. This cannot well go with subsp. *utilis.*

7. Wilson Creek, Fremont Co., *T. S. Brandegee.* Achene-hairs and pappus-scales ferruginous. Like the last but only half as tall.

8. Sangre de Cristo Creek, 7200–8100 ft., July 2, 1900, *Rydberg & Vreeland.* White achene-hairs, slightly ferruginous basally; pappus-scales white with ferruginous base.

9. Hesperus, 8500 ft., July 15, 1896, *Frank Tweedy.* Achene-hairs ferruginous; pappus-scales in same head from ferruginous to ferruginous at base only.

10. Durango, August, 1892, *Alice Eastwood.* Rather a poor specimen. Achene-hairs and pappus very pale ferruginous; the latter might be called sordid white.

11. Salida, August, 1888, *Alice Eastwood.* Achene-hairs and pappus ferruginous; stem not noticeably woolly at base.

12. Saguache Range, 9000 ft., August, 1880, *T. S. Brandegee.* Stem scarcely woolly at base; achene-hairs and pappus-scales pale ferruginous. This seems to be *H. floribunda* proper, from an unusually high altitude. It is a taller plant than the Gunnison and Marshall Pass *utilis.*

The typical *H. floribunda utilis*, it appears, grows in Chaffee, Gunnison, and northern Saguache Counties, at elevations of about 2300–3000 m. This is a region of little rainfall,* and it is probable that this circumstance permits an essentially xerophytic plant to reach such high altitudes, without being in any sense a true alpine. On the eastern slope of the front range of central Colorado, where the plant does not grow, the rainfall is at least twice as great. However, West Cliff (Wet Mountain Valley), the approximate locality of Redfield's plant (which however is not true *utilis*) had in 1902 nearly as much rain as Colorado Springs, *i. e.*, over 15 inches.

* According to data published by F. H. Brandenburg of the Weather Bureau, the rainfall of Buena Vista in 1902 was only 2.81 inches. One suspects here some error; but Saguache had only 7.09 inches, and Salida 7.01.

As has been observed in other species, the color of the pappus and achene-hairs must not be regarded too seriously, as it sometimes varies greatly even in the same head. It seems probable that it darkens in plants which have been long in the herbarium, and perhaps it is affected in some instances by substances used as preservatives.

NEW MEXICO. — 1. Santa Fé and vicinity. (*Fendler 460* = *Heller 423.*) Also on a creek five miles east of Santa Fé, June 30, 1846, *Wislizenus.* The Fendler plant is the type of *H. floribunda;* Heller's plant differs in the outer bracts; see description of subsp. *utilis.*

2. Glorieta, 1881, *G. R. Vasey.* True *H. floribunda.* In 1903 I found it abundantly between Glorieta and Pecos, and at Pecos. The altitude is about 2000 to somewhat over 2100 m. One Glorieta sheet from Vasey, and a sheet from near Santa Fé collected by Rusby, show smaller heads than usual, but are true *H. floribunda.*

3. Chama, *Baker 607.* Three sheets of this examined: rays pale canary yellow; white pappus-scales and achene-hairs in the manner of subsp. *utilis;* stem-leaves longer and broader than in typical *H. floribunda.* Outer bracts united nearly to middle, straight-sided, green; broader and shorter than in Heller's Santa Fé plant. Chama is only just south of the Colorado line.

4. Galisteo, *Dr. J. M. Bigelow.* Remarkably short (about 10 cm. tall), with very numerous fairly large flowers; pappus-scales and achenes light ferruginous; bracts as in true *H. floribunda.*

5. Grant's, *Jones 4352.* Outer bracts like subsp. *utilis;* pappus-scales rather short, these and achene-hairs very pale ferruginous. A sheet from mountains west of Grant's, Aug. 1, 1892 (*Wooton*), shows plants of the first year.

6. Santa Fé, *Herrick 789.* Pappus-scales sordid white, quite broad and not very long, the awns much shorter than in Fendler's type; bracts rather in the style of *utilis.*

7. Defiance, *C. C. Marsh 227.* Basal leaves entire; achene-hairs and pappus-scales ferruginous, the latter not long-awned.

8. Between Barranca and Embudo, Taos Co., 5900–6900 ft., May 27, 1887, *Heller 3602.* Just coming into flower; basal leaves divided; rays quite orange; pappus, etc., pale ferruginous.

9. Goat Mountain, Raton, Aug., 1900, *T. D. A. & W. P. Cockerell.* Basal leaves divided; bracts like *utilis*, outer united at least half-way up; pappus-scales white, achene-hairs slightly ferruginous. Raton is just south of the Colorado line, south of Trinidad, Colorado. The plant here gets well east of the front range. The large grasshopper *Leprus cyaneus* appears to have the same distribution, *i. e.*, only west of the front range in central Colorado, but passing east of it in northern New Mexico.

10. Mountains S. E. of Patterson, 6000 ft., *E. O. Wooton.* Plant low, rays chrome yellow; achene-hairs shining brownish-white; pappus-scales white, ferruginous at base. A bushy plant of rather peculiar aspect, with slender crowns; it is referred to var. *intermedia*, concerning which see below.

ARIZONA. — 1. Near Flagstaff, *MacDougal 219.* Achene-hairs pale ferruginous; pappus-scales broad and not long-awned, dullish white. This is subsp. *arizonica.* Also collected by *J. W. Toumey* at Flagstaff, Aug. 30, 1899, with achene-hairs white except at base.

2. San Francisco Mountain, Sept., 1884, *J. G. Lemmon.* Achene-hairs pale ferruginous; pappus-scales ferruginous, longish-pointed but short. Also subsp. *arizonica.*

3. Western foothill region of San Francisco Peak, 5700 ft., July 3, 1901, *J. B. Leiberg.* Outer bracts divided below middle; pappus-scales short. Also subsp. *arizonica.*

4. Williams, Aug. 28, 1884, *M. E. Jones.* Also subsp. *arizonica.*

5. Rim of Grand Cañon, Hance's Ranch, 7500 ft., July 12, 1892, *E. O. Wooton.* Heads larger than usual; outer bracts green and deeply cleft; pappus, etc., as in subsp. *arizonica*, which it is. Also collected at same place and date by *J. W. Toumey.*

6. About Walnut Cañon, 7000 ft., July 28, 1898, *MacDougal 359.* Slender pale plants; flowers quite orange; achene-hairs pale ferruginous; pappus-scales quite white, with ferruginous bases, fairly long-pointed; crowns slender. This is labelled *P. intermedia* Heller, but seems never to have been published. It should be collected in older material, when it would, I believe, be found to look like Wooton's plant from S. E. of Patterson, N. M., which exactly agrees in the character of the disc-florets.* For the

* In the Gray Herbarium is some older material, confirming this opinion.

present it may stand as var. **intermedia**; I do not think it can possibly be regarded as a valid species. It has nothing to do with the *odorata* series, though the plants have a certain superficial resemblance to the annuals of southern New Mexico.

Hymenoxys Earlei (Ckll.)

Picradenia Earlei Cockerell, Bull. Colo. College Museum, December 11, 1903.

Apparently perennial, erect, as tall as *H. floribunda*, and with much the same manner of growth, but less spreading; leaves similar to those of *H. floribunda*, but segments inclined to be broader; stems reddened at base, without cottony tomentum; heads broader in proportion to their length than in *H. floribunda*, rays orange (clear yellow in *H. floribunda*); outer bracts yellowish, broad and obtuse, strongly convex, united not over one-third; pappus-scales (viewed by transmitted light in glycerine) ferruginous, pointed but not at all aristate; corolla cylindrical, not expanded above. The rays are only about 1 mm. broad. The inner bracts are much thickened dorsally. (PLATE 21, FIGURE 1.)

Mancos, Southern Colorado, in the piñon belt, July 8, 1898, *Baker, Earle & Tracy*. Type in herb. University of Wyoming. Other sheets from the same original lot are in the herbaria of the National Museum, the California Academy of Sciences, the Missouri Botanical Garden, and the New Mexico Agricultural College. Those in the last-mentioned herbarium are dwarfed plants, like those mentioned as frequently occuring in *H. floribunda*.

A rather unsatisfactory specimen, with scanty foliage, is from San Luis Park, Colorado, 1877, *J. D. Hooker & A. Gray*, in herb. Calif. Academy of Sciences. It has the pappus-scales longer-pointed than in the type, but the manner of growth, foliage, etc., are those of *H. Earlei*.

It is not altogether impossible that *H. Earlei* may be connected by intermediates with *H. floribunda*, but I expect that field-study will only emphasize its distinctions.

Hymenoxys Metcalfei sp. nov.

Perennial or at least biennial, when well developed 36 cm. high, but sometimes not over 16 cm.; stems one to two or three, these and the foliage a lively green, basal leaves inclined to spread, but the plant as a whole little spreading; base of stems little

woolly: basal leaves up to about 7 cm. long, some entire, but some (the longer) always divided into about five broad-linear segments; stem-leaves similar in character: inflorescence rather flat-topped, heads (excluding rays) about 10 mm. diameter; rays 10 mm. long, and 5 mm. broad, of the most brilliant orange; bracts light green, outer bracts united nearly half way up, 8 in number, extending very little beyond inner; inner bracts of the *H. floribunda* type, strongly fringed: achenes pallid, their hairs very long, pale, mostly simple-tipped; pappus-scales long-acuminate, quite colorless except at extreme base, where they are ferruginous, over half length of disc-corolla: base of disc-corolla hairy: anthers rather narrow. (PLATE 21, FIGURE 3.)

Burro Mts., New Mexico, *O. B. Metcalfe 170*. The type was kindly sent to me by Prof. E. O. Wooton; it will be placed in the National Museum. Another sheet, of smaller plants, is in the herbarium of Professor Wooton, who collected the material on the northwest peak of Burro Mts., Grant Co., N. M., Aug. 18, 1902. An undersized plant in poor condition, collected by *F. H. Snow* in the Santa Fé mountains, August, looks like *H. Metcalfei*, but is perhaps only a peculiar state of *H. floribunda*, from unusually damp ground. It has the rays hardly developed, and is only 17 cm. tall, but it has leaves with comparatively broad segments, and rather the cut of *H. Metcalfei*.

H. Metcalfei is one of the most beautiful species of the genus, with very much the growth of some forms of *H. floribunda*, but bright orange rays reminding one of *H. helenioides*. It is easily known from *H. Rusbyi* by the divided basal leaves, character of the pappus, etc. It is as near to *H. Earlei* as to anything, but the latter has more olive-green foliage, smaller flowers with different bracts and much less conspicuous rays, and longer basal leaves. The manner of growth is about the same in the two.

Hymenoxys Vaseyi (Gray)

Actinella Vaseyi Gray, Proc. Am. Acad. **17**: 219. 1882.
Picradenia Vaseyi Greene, Pittonia, **3**: 272. 1898.

A bushy, glabrous plant about 30 cm. high or rather more, with heads about 10 mm. broad (excluding rays) on quite long peduncles; the outer bracts united about half-way up (more or less), light yellowish, firm, with a strong longitudinal ridge. The growth of the plant reminds one of the mountain forms of the

odorata series; the foliage is quite a pale green, the leaves and their divisions narrowly linear. One specimen has the basal half of the stems dark red. The inner bracts are truncate and fimbriate, and have not long points. Hair of achenes ferruginous, varying to practically colorless; pappus-scales colorless, about or a little over half length of disc-corolla, decidedly pointed but not aristate. Base of disc-corolla densely hairy. Rays 5.75 mm. broad, pale orange.

Only known from the Organ mountains, in southern New Mexico. I have examined specimens collected by *Vasey* and several sheets collected by *E. O. Wooton* in the Organ Mts., at 5800 ft., July 1897. Professor Wooton also sends me a specimen collected by *Prof. J. D. Tinsley* in Fillmore cañon, Organ Mts., Aug. 27, 1897. Without being positive, I believe that *H. Vaseyi* must be the undetermined plant, not in flower, on which the coccid *Pulvinaria marmorata* Ckll. (Entom. 1898: 130) was discovered.

Hymenoxys Cooperi (Gray)

Actinella Cooperi Gray, Proc. Am. Acad. **7**: 359. 1868.
Picradenia Cooperi Greene, Pittonia, **3**: 272. 1898.

This species differs from *H. Rusbyi* by its larger, fewer heads and much more lax growth; from *H. Vaseyi* by its somewhat larger heads, taller growth, and generally less leafy stems. The form of *H. Cooperi* occurring in the Huachuca and Rincon Mts. of Arizona is so near *H. Vaseyi* that I thought at one time to reduce the latter to a subspecies, but renewed study convinces me that the evidence would not warrant this. Mr. Greenman writes me that he has compared Gray's types of *Actinella Cooperi* and *Actinella Vaseyi*, and believes them distinct.

I have not seen typical *H. Cooperi*, except some fragments from Gray's type (from Providence Mountain, Mohave District, California, 1860–61, *Dr. J. G. Cooper*) very kindly sent by Mr. Greenman.* These show the achenes densely covered with ferruginous hair; pappus-scales short as in the other forms, thick, very deep ferruginous, with a sort of purplish tint; rays narrower than the Huachuca Mts. plant, and about 6-nerved. Mr. Greenman, after comparing the Huachuca Mt. plant with Gray's type of *H.*

* I have since seen the type sheet. The specimen is little more than a fragment, and affords no new evidence.

Cooperi, is somewhat in doubt regarding their specific identity, notwithstanding that Gray considered the former to be *A. Cooperi*. He adds, "the involucral bracts seem fewer and broader."

Mr. Greenman writes that the type of *A. Cooperi* is a very poor specimen; only the upper portion of a plant with one perfect head and an incomplete one. There is no Californian *A. Cooperi* in the herbaria of the Calif. Acad. Sci., National Museum or Missouri Botannical Garden.

Considering all the evidence available, I believe that the Arizona plant must be treated as a distinct subspecies, which is accordingly described.

Hymenoxys Cooperi Grayi subsp nov.

The type specimen (in U. S. Nat. Museum) is Lemmon's *2774*, Huachuca Mts., Arizona, June–Sept. 1882. These mountains are in Cochise Co., south of Benson, and just north of the Mexican border. The achenes are very broad, subquadrangular, 4-nerved on each face, and little pubescent, what hair there is being pale ferruginous. The pappus-scales are white, broad and very short; in one plant of the same lot (hb. Cal. Acad. Sci.) they are ferruginous. In well-developed specimens the basal leaves are very numerous.

The character of the achene is unique in this group, but it may be abnormal or due to greater maturity, as other specimens of undoubtedly the same species have quite ordinary achenes.

The following material is also referred to *H. Cooperi Grayi*:

1. Near Fort Huachuca, Arizona, September, 1894, *T. E. Wilcox*. Form slender and color light; no stout basal tuft; lower cauline leaves 8 or 9 cm. long, irregularly divided into 7 to 9 linear segments, these leaves are a curious whitish green, but quite glabrous; stems green, with only the faintest reddening at base; rays yellow; heads (excluding rays) about 12 mm. diameter; outer bracts thickened and carinate basally, apical part green; inner bracts broad, with long obtuse finger-like tips, sides of bracts copiously white-woolly. The outer bracts are seven in number. Receptacle conical; hair of achenes deep ferruginous; pappus-scales about half the length of disc-corolla, shining rather sordid white, deep ferruginous at extreme base, subacuminate but not in the least awned. This is unquestionably the same as subsp. *Grayi*.

2. Rincon Mts., Arizona, Sept. 1891, *G. C. Nealley*. Basal leaves narrowly linear and entire; caudex multicipital in one specimen; hair of achenes ferruginous; pappus-scales very short, white tinged with ferruginous.

It is hardly possible to rely on the character of the pappus to distinguish the forms of *H. Cooperi* from *H. Rusbyi*, but the aspect of the plants is extremely different.

A modified form of the above, which I call var. **argyrea**, occurs in the region of the Grand Cañon. It has some resemblance to *H. canescens biennis*, but unquestionably belongs with *H. Cooperi*. Its characters are as follows:

Root larger, 10 mm. broad: stem single, rather slender, about 6 dm. high, branching about the middle, with long, slender branches having few linear leaves, terminated by heads hardly 15 mm. broad excluding rays; rays narrow, about 13 mm. long; outer bracts eight, pale green, straight-sided, fairly broad; inner broad and fimbriate, with short green tips: disc-corollas as in *H. canescens biennis*, very pubescent and swollen basally: hair of achenes, and pappus, silvery-white, pappus-scales pointed but not awned. The stem is reddened, strongly grooved, glabrous except at extreme base; basal leaves as in *H. canescens biennis*. This is from about the Grand Cañon of the Colorado, 7,000 feet, June 28, 1898, *Dr. D. T. MacDougal*, in herb. U. S. Nat. Museum. Exactly the same thing is from the Grand Cañon north of Flagstaff, June 14, about 2,000 feet on rocks, *D. T. MacDougal 207*. I take it that this var. *argyrea* is more xerophytic than subsp. *Grayi*; perhaps some of the difference is not truly racial.

Hymenoxys Rusbyi (Gray)

Actinella Rusbyi Gray, Proc. Am. Acad. **19**: 33. 1883.
Picradenia Rusbyi Greene, Pittonia, **3**: 271. 1898.

Tall and bushy, with very numerous rather small heads, the rays inconspicuous, but the disc-florets prominent and bright orange; involucral bracts with prominent dorsal ridges; basal leaves long and linear, about 15 cm. long, simple and grass-like; pappus-scales very short, subtruncate to somewhat pointed, the apical margin serrulate. Rusby has written on a sheet of his collection, "I mistook it for *Senecio eremophilus*," a remark which at

once suggests the appearance of the plant, especially the flowers.* The pappus-scales are ordinarily dark ferruginous, but in Wooton's plant from mountains north of Santa Rita, they vary from white to ferruginous in the same head. The disc-corollas have the upper part broad, but not at all suddenly expanded at the top as in the *odorata* series. The upper hairs of the achenes and flattened; some are bifid at the tips. There is no woolliness at the base of the plant.

I have examined Rusby's *216*, from grassy hills, Clairmont, N. M., and also Rusby's *246½* (three sheets) from grassy places, Mogollon Mts., N. M., August, 1881. More recent specimens are *Wooton's* from mountains north of Santa Rita, S. E. of Mogollon Mts., Socorro Co., N. M., 6,000 ft., August, 23, 1900, and Devil's Park, Mogollon Mts., August 9, 1900. Another plant collected by Professor Wooton is from Lower Plaza, Frisco, N. W. of Mogollon Mts., Socorro Co., N. M., alt. approx. 6,000 ft., July 25, 1900.

Some small slender plants with few heads, the basal leaves wanting, were collected by *Dr. MacDougal*, August 1, 1891, in dry soil, Rattlesnake Tanks, east of Flagstaff, Arizona. The heads, pappus, &c., are exactly those of *H. Rusbyi*, and I cannot do otherwise than refer them to that species. Whether they are merely starved specimens, or represent a race (as one might expect from the locality) I cannot now say.

Hymenoxys olivacea sp. nov.

Apparently perennial: well-developed plants nearly 30 cm. high, but some only 10 cm.: foliage a dark olive green, the leaves glabrous and strongly glandular-punctate, linear, but the stem-leaves up to 2.5 mm. broad, both the basal and stem-leaves entire, or some of the upper stem-leaves with linear lateral lobes; basal leaves 6 to 10 cm. long, similar in character to those of *H. Rusbyi:* heads (excluding rays) 8 to 10 mm. broad, not very numerous, on long peduncles; rays ordinary, broad, pale orange; outer bracts united to or beyond the middle, thickened dorsally, pale in color; inner bracts as usual in the group, strongly fimbriate; receptacle elevated, rounded, somewhat higher than broad: achenes densely covered with pale to deep ferruginous hair; pappus-scales pale or

* Dr. Greene well defines it as "a large green and glabrous corymbose-panicled species."

dark ferruginous, about two thirds length of disc-corolla, very broad at base, with more or less of a lobe on each side, and with a rather long linear apical portion, so that they might be called short-aristate: disc-corollas quite glandular. (PLATE 22, FIGURE 2.)

I have before me five sheets of this plant; two represent *no. 633* of the Emory Survey, said to be (*i. e.*, the whole collection) chiefly from "the valley of the Rio Grande, below Doña Ana," New Mexico; one is Wright's *1260*, of his New Mexico collection of 1851–52; two were collected by Miss A. Isabel Mulford, *no. 807*, "Hanover Hills, 8, 9, 95," and *809*, "Santa Rita, 8, 9, 95," both places in New Mexico. The latter specimen is only in bud. One of the Wright specimens has entangled among its basal leaves a small leaf of *Quercus*, apparently *Q. Emoryi*, which indicates the sort of place the plant inhabits.

It takes the whole series to get the best idea of the true characteristics of this plant, but I take as the type Miss Mulford's *807*, in Dr. Greene's herbarium, for the reason that it is the only one in flower with a precise locality given.

H. olivacea has a decided resemblance to *H. subintegra*, but that is a pale, decidedly canescent plant, with broader, more lobed cauline leaves and larger heads. The peduncles also are stiff; in *H. olivacea* they are more or less flexuous.

Hymenoxys latissima sp. nov.

Plant doubtless tall, but only tops seen; stem slender, light yellowish, strongly grooved, more or less beset with loose white hairs, especially about the bases of the leaves: cauline leaves alternate, sessile, pale yellowish green, elongate-oval, entire, pointed at the apex, strongly punctate, not obviously nerved, glabrous except for scattered white hairs forming a sort of loose and scanty arachnoid pubescence on both surfaces; length of leaf about 30 mm., breadth little over 13, uppermost leaves smaller: heads hemispherical, the surface very convex, about 19 mm. broad excluding rays, on long and slender but apparently rigid peduncles; rays large and conspicuous, yellow (probably inclining to orange), over 20 mm. long, and fairly broad; base of head very woolly; outer bracts green, rather narrow, not united to middle; inner with long pointed tips and straight sides, not fimbriate; receptacle large, high-conical, rounded at apex: achenes narrow, yellowish-ferruginous, with white hairs not concealing the body-color: disc-corollas rather broadened to the apex: pappus-scales white, nearly

three quarters length of disc-corolla, long-pointed, sometimes bifid-tipped. (PLATE 21, FIGURE 2.)

A remarkable species, represented only by some much broken material in the herbarium of Dr. E. L. Greene, marked Southern California, communicated by Wickson. The heads, and even the bracts, suggest *Macdougalia*, but the broad punctate leaves are quite different from that, or from any other *Hymenoxys*.

Hymenoxys texana (Coulter & Rose)

Actinella (*Hymenoxis*) *texana* Coulter and Rose, Bot. Gaz. **16**: 27. 1891. — Coulter, Botany of Western Texas, 231. 1892.

Picradenia texana Greene, Pittonia, **3**: 273. 1898.

The original description is as follows: "A small slender annual 5 to 15 cm. high, branching at base; leaves mostly radical, 3-nerved, oblong and tapering at base, entire or few-toothed; those of the stem narrower and toothed, becoming linear and entire above: heads small (4 to 6 mm. high): involucral bracts in two series; the outer ones about 8, rigid and keeled, united at base: rays minute, not projecting beyond the bracts; achenes pyramidal, 1 mm. long: pappus of 5 oval paleae with aristate acuminations very conspicuous in mature heads. Collected by F. W. Thurow, near Hockley, Texas, 1889 and 1890; also mounted on a sheet with *A. odorata* (No. 742) of Palmer's 1879–80 collection from S. W. Texas."

The type sheet collected by *Thurow* (U. S. N. M. *27467*) is before me. The plant probably appears in the early spring, along with other small annuals. Its general aspect is much like that of *Syntrichopappus Lemmoni* (Gray) Gray, from the Mojave Desert, at least as seen in the herbarium; from its better-developed rays, the *Syntrichopappus* must appear more different when alive. The stem-leaves are very small, and vary from linear to broad, obtuse, with short lateral lobes. These broad leaves are very characteristic, and are totally different from the divided leaves, with wire-like divisions, of *H. odorata*. The inner bracts are essentially as in the *odorata*-type. The pappus-scales, and the hair on the achenes, are white. The receptacle is excessively high-conical, so as to be very narrow and almost cylindrical, the pits large and deep. In *H. odorata* the receptacle is conical, but very much broader.

HYMENOXYS ODORATA DC.

DeCandolle described this in 1836 as *Hymenoxys odorata*. It was said to be part of *Cephalophora anthemoides*, Less., in Linnaea, **6**: 518. 1831. In 1898 Dr. Britton tranferred it to *Picradenia*. Prof. A. Nelson has very kindly copied for me the short latin description of DeCandolle. This tells us that the plant was collected by Berlandier, but the record of the precise locality was lost; it was however in "Mexico," which of course means the Mexico of 1836. The descriptive part reads as follows.

"*H. odorata*, invol. squamis lanceolatis acuminatis. Folia multo tenuius pinnatipartita quam prioris. Pedunculi foliis duplo triplove longiores. Ligulæ 5–6 flavae apice grosse tridentatae. Pappi squamellae lanceolatae acuminatae. Capitulum tritum valde odorum."

This has been understood to be the plant which Buckley named *Phileozera multiflora*. Dr. Greene, however, took up Buckley's name, declaring that the plant of DeCandolle could not be recognized. I cannot agree with Dr. Greene that the Texan plant is "much at variance" with that of DeCandolle; on the contrary, I think the description applies very well.* Unfortunately, however, it applies exactly as well to *P. chrysanthemoides*, and therefore I think it had better be dropped, unless the type specimen can be examined and the identity of the plant proved. Even in the latter case, it might be questioned whether a name is valid, when it is defined by a description which does not serve for its identification.

If we accept the view that *chrysanthemoides* and *multiflora* are merely extremes of one species, still *odorata* is not the name of that species, but *chrysanthemoides*, which dates from 1820.

HYMENOXYS CHRYSANTHEMOIDES (H. B. K.) DC. Prodr. **5**: 661. 1836.

Actinea chrysanthemoides H. B. K. Nov. Gen. et Sp. **4**: 298. *pl. 411*. 1820.

Actinella chrysanthemoides Gray, Proc. Am. Acad. **19**: 32. 1883.

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*As regards the odor, however, Dr. Greene writes: "I am positive that all through southern New Mexico the plant called '*odorata*' has but a feeble odor, and that not grateful. I walked over it, and gathered it often enough" (*litt.*, April, 1904).

Typically this is a rather tall plant, up to 50 cm. high, much branched and spreading at the top, with foliage very much like that of *Matricaria grandiflora*, and large (15 mm. broad excluding rays) hemispherical heads on tolerably long peduncles. The rays are ample, and orange. The outer bracts are long and narrow, united for a short distance only, the apical part green. The inner bracts are narrow, long-pointed, and surpass the outer; they show some tendency towards the characters so greatly emphasized in *Macdougalia*. The achenes are as usual in the genus, covered with hair; the pappus-scales are nearly two-thirds the length of the disc-corolla, with long tapering points and broad oval bases. In the plant from the San Luis Potosi region the pappus and hair of the achenes are ferruginous; in the plant from near Chalchicomula they are white. The disc-corollas are broadened at the top as usual in the group. The plant is no doubt an annual.

Specimens referred here are as follows:

MEXICO. — Esperanza, near Mt. Orizaba, 8,000 ft., Aug. 14, 1891, *H. E. Seaton;* about Chalchicomula, 8,500 ft., State of Pueblo, Aug. 13, 1901, *C. G. Pringle;* region of San Luis Potosi, 6,000–8,000 ft., 1878, *C. C. Parry & Edw. Palmer;* Salinas, Zacatecas, May 4, 1892, *M. E. Jones 286*. The wide difference in the time of year of these collections is surprising.

NEW MEXICO? — Three sheets of the Emory Survey, *no. 635*, are labelled *Actinella chrysanthemoides*. They represent very immature and poorly preserved plants, but from the character of the foliage, and the large heads, the identification seems correct.

Hymenoxys chrysanthemoides excurrens var. (vel. subsp.?) nov.

Well-developed plants fully 60 cm. tall, of laxer growth, with olive-green foliage; both outer and inner bracts broader, the inner much like those of *H. chrysanthemoides Osterhouti;* heads not quite so large, and not so convex. (PLATE 22, FIGURE 3.)

The type sheet is from Yuma, Arizona, 1881, *G. R. Vasey*, in U. S. Nat. Museum. Precisely the same thing is from Fort Yuma, San Diego Co., Calif., Feb. 1889, *S. B. & W. F. Parish*, in herb. Cal. Acad. Sci. Both were labelled *odorata*, and the plant does in fact offer a transition towards subsp. *multiflora* (*P. odorata* auctt.). A plant collected by Palmer in Arizona, in 1876 (locality not stated), has all the appearance of *excurrens*, but heads (excl.

rays) only about 9 mm. diameter! At this point I find myself in a difficult position. I am unable to define *H. chrysanthemoides*, subsp. *multiflora*, and the allied forms in such a way as to absolutely separate them. As in the *Richardsoni*-series, the extremes are so different that it seems ridiculous to think of them as allied, but there are innumerable intermediate forms, and structural differences of any consequence simply do not exist. As in *Matricaria* etc., these plants no doubt differ greatly according to the amount of moisture they get, specimens from very dry places being extremely small. At the same time, it is evident that genuine racial differences exist, and these, so far as they can be discerned, may very well be made the basis of subspecific names. To determine the minute characters I examined microscopically the achenes, pappus and corollas of plants from Oklahoma, Kansas, Texas, Chihuahua, New Mexico, and Arizona. The pappus-scales were practically alike in all, with quite long points; in color they were ferruginous of various shades, uniformly light in material from Texas and near Tucson, Arizona, more especially ferruginous at base in some from Las Cruces, N. M., and near Chihuahua. The achenes were essentially the same, as also the disc-corollas. The bracts vary as they always do in the genus, but the differences are unimportant. The high broad receptacle is sometimes (*e. g.*, Chihuahua material) narrower and more conical, but the differences are not striking.

Mr. M. L. Fernald (Am. Jour. Sci. **14**: 189), facing a very similar condition in *Betula*, writes: "But since it is obviously impracticable to regard all these forms as one species, it seems wiser to recognize the more marked centers of variation as species which are admitted to pass by exceptional tendencies to other forms ordinarily distinguished by marked characteristics." Of course it is true that species which are quite distinct in actual fact may seem to intergrade, because of the variation in the characters taken as specific. For example, *Helix nemoralis* is a snail having the lip of the shell black or nearly so, while the closely similar *Helix hortensis* has the lip white. There occur varieties of *H. nemoralis* in which the lip is pallid or even white, and varieties of *H. hortensis* in which it is black. These facts led some good authorities to treat *hortensis* as a variety of *nemoralis*, until it was

discovered that there is a very good and perfectly constant anatomical character which separates the two species.

Similarly, two species of plants may appear to intergrade, without actually doing so; but to the best of my knowledge and belief the "species" of *Richardsoni*- and *chrysanthemoides*-groups of *Hymenoxys* do really intergrade on a quite extensive scale, and believing this, it seems best to use a trinomial nomenclature for them. This results in calling the common plant of Texas *Hymenoxys chrysanthemoides multiflora*, a name which cannot be regarded with much satisfaction. However, I think it will simplify matters if in all but formal statements we use only the initial letter of the intermediate name of a trinomial, thus *Hymenoxys c. multiflora*. This is almost like a binomial, and yet serves to distinguish races or subspecies from distinctly and sharply defined species.

Hymenoxys chrysanthemoides juxta

Picradenia sp. nov., Greene in herb.*

The type is a plant collected by O. B. Metcalfe (*no. 118*) at Mangas Springs, New Mexico, June 9, 1903, alt. 4770 ft. It is a large bushy annual 45 cm. high, with numerous flowers with light orange rays. The heads (excl. rays) are about 8 mm. diameter. The outer bracts are pale green; the inner bracts are very broad (as in *H. Davidsoni*) and extremely thin laterally. The pappus is colorless, about half the length of disc-corolla, with a short awn, perhaps one third of its total length. The disc-florets are smaller than in *H. Davidsoni*, but the difference is unimportant. This plant is not materially different from subsp. *Osterhouti*, except that it is typically larger, with broader bracts, and the basal part of the pappus-scales apparently broader. The two ought perhaps to be united, but they are separated geographically, and it is just possible that subsp. *Osterhouti* had an independent origin from subsp. *multiflora*.

The following plants, not all typical, but I think essentially the same, are referred to this:

MEXICO. — Valley near Chihuahua, April, 1885, *C. G. Pringle*. One of these Pringle plants is very large and robust, but another of the same lot is only half the size; these differences certainly do

* The specific name applied by Greene is preoccupied in *Hymenoxys*.

not appear to be racial. Of the following, the first is tall, but the others are small bushy or low plants, intermediate between the present race and subsp. *multiflora*: "Manzanilla Cimarron, flower yellow, from a bunch forming a beautiful obtuse cone (usual style) 2 feet high and in diameter, Bolson de Mapimi (dry valley)," April 15, 1847, *Dr. J. Gregg*; "Manzanilla del Campo (a species) from wet place in plain S. E. from Presido de Yuajuquilla," April 19, 1847, *Dr. J. Gregg*; "Rio Grande Valley near Juarez, State of Coahuila," 3700 ft., May 5, 1901, *C. G. Pringle*; Sta. Eulalia plains, Chihuahua, 1885, *Wilkinson*; cultivated places on the plains, 6000 ft. alt., State of Chihuahua, April 29, 1891, *C. V. Hartman*; Bachimpa, south of Chihuahua, sandy soil, April 26, 1847, *Dr. A. Wislizenus*; "States of Coahuila and Nuevo Leon," 1880, *Dr. E. Palmer 741*.

The last plant, Palmer's *741*, is ridiculously unlike the Metcalfe plant, being a small densely leafy thing 9 to 12 cm. high. The others, however, are variously intermediate, and without a larger amount of material, or field study, it does not seem possible to define any more subspecies. None of the plants are just exactly the Texan subsp. *multiflora*, though some approach it.

TEXAS. — El Paso, April 17, 1884, *M. E. Jones*; "Texas," April 24, 1883, *C. G. Pringle*; El Paso, April, 1881, *G. R. Vasey*; "from Western Texas to El Paso," October, 1849, *Charles Wright*; El Paso, 1851–52, *C. Wright 1261*; thus all from the extreme western end of the State, not far from New Mexico.

NEW MEXICO. — Emory Survey, *no. 634*; College Farm, Mesilla Valley, May, 1894, *E. O. Wooton*; Rincon, prox. 4,000 ft., June 13, 1892, *E. O. Wooton*; Las Cruces, Mesilla Valley, May 17, 1893, *E. O. Wooton*; River bottom [of the Rio Grande], Mesilla Valley, April 7, 1900, *E. O. Wooton*. These plants, nearly all from the Mesilla Valley, are essentially the same as the El Paso plant. I was familiar with this form in life at Mesilla. It is not usually so large and bushy as the Mangas Springs plant, but it is certainly nearer to it than to the small typical subsp. *multiflora*.

ARIZONA. — Near Tucson, May, 1881, *J. G. Lemmon and wife*,

sienega near Tucson, June 1881, *Lemmon*. This material is not as good as one could wish, but it seems inseparable from the New Mexico plant.

Hymenoxys chrysanthemoides Osterhouti (Cockerell)

Picradenia odorata Osterhouti Cockerell, Bull. Colorado College Museum, December 11, 1903.

The original description is as follows:

"Apparently annual, about 21 cm. high, broad and spreading, much in the manner of *odorata*, root about 5 mm. diameter; stems purplish at base, here neither wooly nor leafy, repeatedly branched, with cauline leaves divided into about five linear segments; heads numerous, with the leaves and mode of growth rather suggestive of *Matricaria*, disc convex, bright orange, about 7 mm. across, rays bright lemon-yellow, rather short; outer bracts divided nearly to base, with rather narrow but obtuse green tip; inner bracts longer than the outer, and rather more pointed, their shape recalling those of *P. Davidsoni*, except that they are by no means so large and broad; receptacle from hemispherical to broad-conical (not narrow conical and pointed as in *utilis*); disc-corollas 3½ mm. long, widened at the top, the lobes pubescent as in *odorata*; pappus-scales not at all ferruginous, rapidly narrowing to a long awn-like point, the whole being nearly half the length of the corolla." [PLATE 23, FIGURE 1.]

"Apishapa Crook, Otero Co., Colorado, June 9, 1900 (in full flower), collected by *Geo. E. Osterhout*. The plant of Kansas and Oklahoma is taken as true *P. odorata*. It has considerably smaller heads than the Colorado plant, with disc-corollas 3 mm. long. It also appears to flower earlier, and the color of the pappus-scales is very different.

"The discovery of *Osterhouti* nearly fills up the interval between *odorata* and *Davidsoni*. The only substantial differences between *Osterhouti* and *Davidsoni* are that the latter is certainly biennial, has the outer bracts the same color as the inner (in *Osterhouti* they are conspicuously tipped and narrowly margined with dark green), and the inner bracts nearly twice as broad as those of *Osterhouti*. It is possible that *Osterhouti* may yet prove biennial, in which case I should consider it a subspecies of *Davidsoni*."

No other material has been seen. There is I think no doubt whatever that the plant is an annual.

Hymenoxys chrysanthemoides Mearnsi subsp. (var.?) nov.

The type of this (U. S. Nat. Mus. *27473*) is from Dog Spring, New Mexico, May 26, 1892, collected by *Dr. E. A. Mearns* on the Mexican Boundary Survey. It is a many-stemmed densely leafy little plant, forming a tuft about 10 cm. high and twice as broad. The foliage is normal for the group, except for its abundance, but there is a good deal of short white almost scurfy hair about the stems and on the involucres. The heads (excl. rays) are about 8 mm. broad, quite convex, with well-developed broad rays; outer bracts broad, united nearly half-way up, green-tipped; inner bracts very broad; hair of achenes pale shining ferruginous; pappus-scales normal for the group, more or less ferruginous. This is a more densely tufted plant than subsp. *multiflora*, and has larger heads. The plant is leafy right up to the flowers, which are very numerous. The pappus-scales are much shorter than the disc-corollas. (PLATE 23, FIGURE 2.)

Quite provisionally, I refer also to subsp. *Mearnsi* a series of small plants having the heads no bigger than those of true *multiflora*, and the peduncles frequently elongated. They do not seem to be exactly *multiflora*, but rather between it and *Mearnsi*. The distribution of these plants seems to show that the *multiflora* type does invade the territory of the tall mountain form, and this may certainly be taken as an argument for the genuine specific distinctness of the two. On the other hand, it could be suggested that these small plants are but conditions of the tall one, similar to the small examples of *H. floribunda*. If the latter supposition is true, the plasticity of the organism is wonderful. The small plants just referred to are:

NEW MEXICO.— Mangas, April, 1897, *J. K. Metcalfe*; near Cliff P.O., in the Gila Valley, approx. 4500 ft., July 12, 1900, *E. O. Wooton*; below Silver City, 5700 ft., July 6, 1900, *E. O. Wooton*.

ARIZONA.— Agency, Mohave reserve, April 1, 1876, *E. Palmer*; San Simon Valley, July 27, 1894, *J. W. Toumey*.

Hymenoxys chrysanthemoides multiflora (Buckley)

Phileozera multiflora Buckley, Proc. Acad. Nat. Sci. Phila. **1861**: 459. 1862.

Picradenia multiflora Greene, Pittonia, **3**: 273. 1898.

This, the smallest member of its series, was thus described by Buckley:

"Plant 4–6 inches high, with numerous erect flowering branches, which are destitute of leaves near the flowers; leaves about half a line wide, elongated, and 3–6 parted, with opposite or alternate segments; whole plant sparingly pubescent; flowers 3–4 lines in diameter; the lower pappus of many white hairs is at the base of, and about equal in length to the achenia; palea nearly as long as the achenia which they crown. The flowers have a resemblance to those of *Riddellia*." The type is from prairies north of Fort Belknap, Texas, in May. Specimens are stated to be in the herbaria of the Philadelphia Academy, and of Elias Durand.

The specimens before me are separable into two groups or series; A, with larger heads and ranker, sometimes confervoid foliage, possibly plants of damper ground; and B, with numerous small heads on usually rigid stems, the plant less inclined to spread, these being apparently plants of dry ground. I am not sure that these are more than states of one thing, and they are not separated by any real interval. At the same time, their distribution is suggestive of true racial differentiation.

FORM A.

TEXAS.— Staked Plains, May 1899, *W. L. Bray*; Sandy plains, Taylor Co., April 1882, *J. Reverchon*; between the Frio and Nueces Rivers, on the road to Laredo, Jan. 27 and 28, 1880, *E. Palmer;* sandy western plains, headwaters of the Llano River, May, 1885, *J. Reverchon*; a fairly uniform lot, except Palmer's plant, which has short curled much-dissected leaves, and looks curiously like some species of *Batrachium*. It perhaps deserves a varietal name.

FORM B.

TEXAS.— Oldham Co., Aug. 13, 1891, *M. A. Carleton.*

NEW MEXICO.— On the upper Canadian, April, 1848, *A. Gordon;* water holes in plains, near McCarty's Ranch, July, 1880,

Henry H. Rusby. The first is a small plant, the second about twice as large.

OKLAHOMA. — Cimarron River, July 13, 1869, *Mark White*; Woods Co., June 29, 1900, *A. H. Van Vleet*; Gloss Mts., July 13, 1899, *Mark White*.

KANSAS. — Coolidge, July 4, 1892, *A. S. Hitchcock*; Buffalo Wallows, Trego Co., July 19, *A. S. Hitchcock*.

Hymenoxys Davidsonii (Greene)

Picradenia Davidsonii Greene, Pittonia, **4**: 240. 1901.

This plant certainly appears to be a biennial, but otherwise it is very close to *Osterhouti* and *anthemoides*; much closer to them, so far as general appearance goes, than they are to *multiflora* or *chrysanthemoides*. Dr. Davidson very kindly sent me some of the original material, from Clifton, Arizona, and also a specimen from Metcalf, Arizona. The latter is of smaller stature (about 12 cm. high), with light green foliage and rather smaller heads (disc flowers about 85 to a head).

The Clifton plant was found along the river bank in the muddy ground; it has about 112 disc-florets to a head; outer bracts 8 or 9. The outer bracts are greenish, pointed, not obviously nerved, with convex sides, and united not over one-third; the inner are longer and larger, very broad, 3-nerved, pointed. The pappus-scales are colorless, broad basally, with a fairly long awn-like end; they are not very much more than half the length of the disc-corolla, which is much widened at the top. The rays are well-developed, 5.75 mm. broad.

INSECTS AND FUNGI ON HYMENOXYS

I have not found any record of a parasitic fungus attacking *Hymenoxys*, though two species of *Puccinia* (*P. Actinellae* (Webber) Sydow, and *P. cornigera* Ell. & Ev.) are known from *Tetraneuris*.

The coccid *Palaeococcus Townsendi* (Ckll.) infests *H. floribunda* at Raton, N. M (see Psyche, 1901: 175).

Two bees are recorded as visiting the flowers: *Halictus armaticeps* Cresson, visits *H. chrysanthemoides juxta* at Mesilla, N. M.,

and *Perdita chrysophila* Ckll., visits *H. floribunda* at Pecos, N. M. The latter observation is due to my wife.

UNIVERSITY OF COLORADO,
BOULDER, COLORADO.

Explanation of plates 20–23

PLATE 20. *Hymenoxys floribunda utilis*
PLATE 21, FIGURE 1. *Hymenoxys Earlei.*
PLATE 21, FIGURE 2. *Hymenoxys latissima.*
PLATE 21, FIGURE 3. *Hymenoxys Metcalfei.*
PLATE 22, FIGURE 1. *Hymenoxys subintegra.*
PLATE 22, FIGURE 2. *Hymenoxys olivacea.*
PLATE 22, FIGURE 3. *Hymenoxys chrysanthemoides excurrens.*
PLATE 23, FIGURE 1. *Hymenoxys chrysanthemoides Osterhouti.*
PLATE 23, FIGURE 2. *Hymenoxys chrysanthemoides Mearnsi.*
All of the figures are from photographs of the type specimens.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1904)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omission their kindness will be appreciated.

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Ames, O. Three new orchid species. Proc. Biol. Soc. Wash. **17**: 119, 120. 9 Je 1904.

New species in *Dendrobium* and *Epidendrum* (2), all described by R. A. Rolfe.

Arthur, J. C. The aecidium of maize rust. Bot. Gaz. **38**: 64–67. 16 Jl 1904.

Ashe, W. W. East American thorns. Jour. Elisha Mitchell Soc. **20**: 47–56. 15 Je 1904.

Descriptions of 18 new species of *Crataegus*.

Atkinson, G. F. Relation of plants to environment (or plant ecology); outlines of a course of lectures. 1–67. Ithaca, N. Y. Je 1904.

With a bibliography.

Bailey, J. W. *Alsia abietina* Sulliv. Bryologist, **7**: 51. 2 My 1904.

Note on the fruiting of this species at Tacoma, Wash.

Bailey, J. W. *Webera Lachenaudi* Card. & Thér. n. sp. Bryologist, **7**: 66. 1 Jl 1904. [Illust.]

Banker, H. J. Notes on the variability of *Hypothele repanda*. Torreya, **4**: 113–117. 27 Au 1904.

Barnes, C. R. The ascent of water in trees. Science, II. **20**: 179. 5 Au 1904.

Barnhart, J. H. The nomenclature of *Hexalectris* and *Aplectrum*. Torreya, **4**: 119–121. 27 Au 1904.

Bateson, W. Practical aspects of the new discoveries in heredity. Mem. Hort. Soc. N. Y. **1**: 1–8. [1904.]

Beach, S. A. Correlation between different parts of the plant in form, color, size and other characteristics. Mem. Hort. Soc. N. Y. **1**: 63–67. [1904.]

Berry, E. W. Two-bracted dogwood. Torreya, **4**: 104. 21 Jl 1904.

Bessey, C. E. Botanical notes. Science, II. **20**: 118, 119. 22 Jl 1904.

The number and weight of cottonwood seeds; weight of dandelion down: tendrils of the Virginia creeper.

Bessey, C. E. Botanical Notes. Science, II. **20**: 217, 218. 12 Au 1904.

Ecological plant studies; animals in the plant kingdom; etc.

Bicknell, E. P. Studies in *Sisyrinchium* — X. The species of California. Bull. Torrey Club, **31**: 379–391. 29 Jl 1904.

With descriptions of 5 new species.

Billings, F. H. A study of *Tillandsia usneoides*. Bot. Gaz. **38**: 99–121. *pl. 8–11* + *f. 1*. 18 Au 1904.

Blakeslee, A. F. Zygospore formation a sexual process. Science, II. **19**: 864–866. 3 Je 1904.

Booth, N. O. A study of grape pollen and what the results indicate. Mem. Hort. Soc. N. Y. **1**: 243–249. [1904.]

Britton, E. G. Further notes on *Sematophyllum*. Bryologist, **7**: 59–61. 1 Jl 1904.

Britton, E. G. Notes on nomenclature, III. Bryologist, **7**: 48–50. 2 My 1904.

Britton, N. L. *Savia bahamensis* sp. nov. Torreya, **4**: 104, 105. 21 Jl 1904.

Britton, N. L. The tropical station at Cinchona, Jamaica. Pop. Sci. Mo. **64**: 427–430. Mr 1904. [Illust.]

Britton, N. L. An undescribed species of *Alnus*. Torreya, **4**: 124. 27 Au 1904.

A. noveboracensis sp. nov.

Burbank, L. Some of the fundamental principles of plant breeding. Mem. Hort. Soc. N. Y. **1**: 35–39. [1904.]

Burbidge, F. W. Hybridism *vs.* selection. Mem. Hort. Soc. N. Y. **1**: 231–234. [1904.]

Cannon, W. A. Observations on the germination of *Phoradendron villosum* and *P. californicum*. Bull. Torrey Club, **31**: 435–443. *f. 1–6*. 26 Au 1904.

Cannon, W. A. Some cytological aspects of hybrids. Mem. Hort. Soc. N. Y. **1**: 89–92. [1904.]

Chamberlain, C. J. A correction. Bot. Gaz. **38**: 145. 18 Au 1904.

Christman, A. H. Variability in our common species of *Dictyophora*. Jour. Myc. **10**: 101–108. 31 My 1904.

Claassen, E. List of the mosses of Cuyahoga and other counties of northern Ohio. Ohio Nat. **4**: 157–160. 1 My 1904.

Clark, A. G. An interesting specimen of *Arisaema triphyllum* Torr. Rhodora, **6**: 163. 14 Jl 1904. [Illust.]

Cockerell, T. D. A. A new *Hypholoma*. Journ. Myc. **10**: 108, 109. 31 My 1904.

H. pecosense sp. nov.

Collins, J. F. Some interesting Rhode Island bogs. Rhodora, **6**: 149, 150. 14 Jl 1904.

Collins, J. F. Some Maine mosses. Rhodora, **6**: 145, 146. 15 Je 1904.

Cook, O. F. Evolution not the origin of species. Pop. Sci. Mo. **64**: 445–456. Mr 1904.

Cooley, G. E. Silvicultural features of *Larix americana*. Forestry Quart. **2**: 148–160. My 1904.

Cowles, H. C. The work of the year 1903 in ecology. Science, II. **19**: 879–885. 10 Je 1904.

Cresson, E. T. *Buxbaumia aphylla* L. Bryologist, **7**: 51, 52. 2 My 1904.

Note on its occurrence near Philadelphia.

Cushman, J. A. Notes on *Micrasterias* from southeastern Massachusetts. Bull. Torrey Club, **31**: 393–397. *f. 1–3*. 29 Jl 1904.

Darbishire, O. V. Observations on *Mamillaria elongata*. Ann. Bot. **18**: 375–416. *pl. 25, 26*. Jl 1904.

Davis, B. M. Oogenesis in *Vaucheria*. Bot. Gaz. **38**: 81–98. *pl. 6, 7*. 18 Au 1904.

Davis, W. T. Botanical notes. Additions to the flora [of Staten Island]. Proc. Nat. Sci. Assoc. Staten Island, **9**: 22, 23. 14 My 1904.

Davis, W. T. *Wolffia* in the Clove valley. Proc. Nat. Sci. Assoc. Staten Island, **9**: 19. 9 Ap 1904.

Deane, W. Preliminary lists of New England plants, — XVII. Rhodora, **6**: 151–161. 14 Jl 1904.

De Vries, H. On artificial atavism. Mem. Hort. Soc. N. Y. **1**: 17–23. [1904.]

Dewey, L. H. Principal commercial plant fibers. Yearbook U. S. Dept. Agric. **1903**: 387–398. *pl. 45–49*. 1904.

Doran, G. Sullivant Moss Chapter notes. Bryologist, **7**: 67. 1 Jl 1904.

Durand, E. J. Three new species of *Discomycetes*. Jour. Myc. **10**: 99–101. 31 My 1904.
New species in *Lachnum* and *Dermatea* (2).

Eastman, H. New England ferns and their common allies. i–xxi. 1–161. Boston, Jl 1904. [Illust.]

Eastwood, A. Hans Hermann Behr. Science, II. **19**: 636. 15 Ap 1904.

Eastwood, A. A new *Gilia*. Bot. Gaz. **38**: 71, 72. 16 Jl 1904.
G. sapphirina sp. nov.

Eaton, A. A. Note on *Equisetum pratense*. Rhodora, **6**: 92. 2 My 1904.

Eggleston, W. W. Addenda to the flora of Vermont. Rhodora, **6**: 137–144. 15 Je 1904.

Ellis, J. B. & Everhart, B. M. New species of fungi from various localities. Jour. Myc. **10**: 167–170. 24 Je 1904.
Descriptions of 16 new species in 15 genera.

Elrod, M. J. The University of Montana Biological Station and its work. Science, II. **20**: 205–212. 12 Au 1904.

Fernald, M. L. The green alders of New England. Rhodora, **6**: 162, 163. 14 Jl 1904.
With a description of *Alnus mollis* sp. nov.

Fernald, M. L. The identity of Michaux's *Lycopus uniflorus*. Rhodora, **6**: 134–137. 15 Je 1904.

Fernald, M. L. Some new species of Mexican and Nicaraguan dicotyledons. Proc. Am. Acad. Arts & Sci. **40**: 52–57. 18 Jl 1904.
New species in *Chlorophora*, *Cordia*, *Salvia* (6), *Acnistus*, *Castilleja* (2), *Utricularia* and *Pectis*.

Fernald, M. L. Synopsis of the Mexican and Central American species of *Alnus*. Proc. Am. Acad. Arts & Sci. **40**: 24–28. 18 Jl 1904.
One sew species is described.

Fink, B. Further notes on cladonias. — III. Bryologist, **7**: 53–58. *pl. 7 + f. 1, 2*. 1 Jl 1904.

Gilbert, B. D. Mounting mosses. Bryologist, **7**: 61, 62. 1 Jl 1904.

Gilg, E. Beiträge zur Kenntnis der Ochnaceen, besonders im Hinblick auf die neueste Bearbeitung dieser Pflanzenfamilie durch Van Tieghem. Festschr. 70-ten Geburtst. Ascherson, 97–117. 1904.

The criticism is based chiefly upon African material, but applies as well to Van Tieghem's work upon the American representatives of the family.

Greenman J. M. Diagnoses and synonymy of Mexican and Central American spermatophytes. Proc. Am. Acad. Arts & Sci. **40**: 28–52. 18 Jl 1904.

Includes descriptions of 39 new species in 33 genera.

Griggs, R. F. Two new species of American wild bananas with a revision of the generic name. Bull. Torrey Club, **31**: 445–447. 26 Au 1904.

Bihai reticulata sp. nov. and *B. longa* sp. nov.

Grout, A. J. A note. Bryologist, **7**: 40. 2 My 1904.

In reference to the reported occurrence of *Heterocladium squarrosulum* in Vermont.

Grout, A. J. The peristome, VI. Bryologist, **7**: 37–39. *pl. 4 + f. 1.* 2 My 1904.

Grout, A. J. The specific (?) value of the position of the reproductive organs in *Bryum*. Bryologist, **7**: 50, 51. 2 My 1904.

Grout, A. J. *Tortula pagorum* (Milde) DeNot. in Georgia. Bryologist, **7**: 65. *pl. 8.* 1 Jl 1904.

Gruenberg, B. C. & Gies, W. J. Chemical notes on "bastard" logwood. Bull. Torrey Club, **31**: 367–377. *f. 1, 2.* 29 Jl 1904.

Harding, H. A. & Stewart, F. C. Vitality of *Pseudomonas campestris* (Pam.) Smith on cabbage seed. Science, II. **20**: 55, 56. 8 Jl 1904.

Harper, R. M. *Sarracenia flava* in Virginia. Torreya, **4**: 123. 27 Au 1904.

Harris, C. W. Lichens—*Collema* and *Leptogium*. Bryologist, **7**: 46–48. *pl. 6.* 2 My 1904.

Hartley, C. P. Improvement of corn by breeding. Mem. Hort. Soc. N. Y. **1**: 199–208. *f. 1–6.* [1904.]

Hayek, A. von. Kritische Uebersicht über die *Anemone*-Arten aus der Section *Campanaria* Endl. und Studien über deren phylogenetischen Zusammenhang. Festschr. 70-ten Geburtst. Ascherson, 451–475. 1904.

Hays, W. M. Breeding for intrinsic qualities. Mem. Hort. Soc. N. Y. **1**:5 5–62. [1904.]

Hecke, L. Ueber das Auftreten von *Plasmopara cubensis* in Oesterreich. Ann. Myc. **2**: 355–358. 31 Jl 1904.

Hemsley, W. B. *Bulbophyllum Weddelii*. Curt. Bot. Mag. III. **60**: *pl. 7958.* 1 Je 1904.

Native of Brazil.

Hemsley, W. B. *Chamaedora pulchella.* Curt. Bot. Mag. III. **60**: *pl. 7959.* 1 Je 1904.
Native of tropical America.

Hemsley, W. B. *Geonoma gracilis.* Curt. Bot. Mag. III. **60**: *pl. 7963.* 1 Jl 1904.
Native of tropical America.

Hennings, P. Einige neue Pilze aus Costarica und Paraguay. Hedwigia, **43**: 147–149. 16 My 1904.
New species in *Puccinia, Lachnocladium, Phyllachora, Auerswaldia, Dothidella, Balansia* and *Aschersonia.*

Hennings, P. *Fungi* amazonici I a cl. Ernesto Ule collecti. Hedwigia, **43**: 154–186. 16 My 1904.
Includes descriptions of 89 new species in 28 genera.

Hennings, P. *Fungi* amazonici II a cl. Ernesto Ule collecti. Hedwigia, **43**: 242–273. *pl. 4.* 12 Je 1904. [Illust.]
Includes descriptions of 76 new species in 37 genera, of which 4 are new: *Hypoxylonopsis, Parmulariella, Uleopeltis* and *Rehmiomyces.*

Hennings, P. *Fungi* s.-paulenses III a cl. Puttemans collecti. Hedwigia, **43**: 197–208. 16 My 1904; 209. 12 Je 1904.
Includes descriptions of 23 new species in 20 genera.

Hennings, P. Die Gattung *Aschersonia* Mont. Festschr. 70-ten Geburtst. Ascherson, 68–72. 1904.
Maintains this name (1848) in spite of the older *Aschersonia* of Endlicher (1842).

Hervey, E. W. Plants new to the flora of New Bedford. Rhodora, **6**: 144. 15 Je 1904.

Hill, E. J. Note on the polygamy of *Chionanthus.* Rhodora, **6**: 89. 2 My 1904.

Hitchcock, A. S. Notes on North American grasses, III. Bot. Gaz. **38**: 139–143. 18 Au 1904.

Holway, E. W. D. Notes on *Uredineae,* II. Jour. Myc. **10**: 163–165. 24 Je 1904.
Includes descriptions of 4 new species of *Puccinia.*

Holzinger, J. M. A bryologist's glimpse into geological history. Bryologist, **7**: 42, 43. 2 My 1904.

Holzinger, J. M. *Rhacomitrium Flettii* n. sp. Bryologist, **7**: 41. *pl. 5.* 2 My 1904.

Hubrecht, A. A. W. Hugo de Vries's theory of mutation. Pop. Sci. Mo. **65**: 205–223. Jl 1904.

Hurst, C. C. Notes on Mendel's methods of cross-breeding. Mem. Hort. Soc. N. Y. **1**: 11–15. [1904.]

Jelliffe, S. E. Additions to "The flora of Long Island." Torreya, **4**: 97–100. 21 Jl 1904.

Kellerman, W. A. Cultures of *Puccinia Thompsonii* Hume. Jour. Myc. **10**: 173, 174. 24 Je 1904.

Kellerman, W. A. Elementary mycology. Jour. Myc. **10**: 144–149. *f. 1–5.* 31 My 1904; 174–182. *f. 7–14.* 24 Je 1904.

Kellerman, W. A. Flora of Cedar Point. Ohio Nat. **4**: 186–190. 1 Je 1904.

Kellerman, W. A. Flora of Hen and Chicken Islands, 1903. Ohio Nat. **4**: 190, 191. 1 Je 1904.

Kellerman, W. A. Minor mycological notes, IV. Jour. Myc. **10**: 114–116. 31 My 1904.

Kellerman, W. A A new species of *Naemosphaera.* Jour. Myc. **10**: 113, 114. 31 My 1904. [Illust.]
N. lactucicola sp. nov.

Kellerman, W. A. A new species of *Peronospora.* Jour. Myc. **10**: 171, 172. *pl. 74.* 24 Je 1904.
P. Floerkeae sp. nov.

Kennedy, G. G. Additional notes from Willoughby. Rhodora, **6**: 148. 15 Je 1904.

Kennedy, G. G. Flora of Willoughby, Vermont. Rhodora, **6**: 93–134. *pl. 54–56* + *map.* 15 Je 1904

Klugh, A. B. The fertilization of *Calopogon pulchellus.* Ottawa Nat. **18**: 107. 10 Au 1904.

Knight, O. W. A new sunflower for Maine. Rhodora, **6**: 147. 15 Je 1904.

Knight, O. W. Some plants new to the flora of Maine. Rhodora, **6**: 91, 92. 2 My 1904.

Krieger, W. Ein Beitrag zur Kenntnis der Moosflora von Uruguay. Hedwigia, **43**: 349, 350. 15 Jl 1904.

Land, W. J. G. Spermatogenesis and oogenesis in *Ephedra trifurca.* Bot. Gaz. **38**: 1–18. *pl. 1–5.* 16 Jl 1904.

Lawson, A. A. The gametophytes, fertilization and embryo of *Cryptomeria japonica.* Ann. Bot. **18**: 417–444. *pl. 27–30.* Jl 1904.

Lindman, C. A. M. Neue Speziesnamen einiger südamerikanischer Farne. Hedwigia, **43**: 308–311. *f. 1–3.* 15 Jl 1904.
With a description of *Acrostichum Curupirae* sp. nov.

Livingston, B. E. & Jensen, G. H. An experiment on the relation of soil physics to plant growth. Bot. Gaz. **38**: 67–71. 16 Jl 1904.

Lloyd, F. E. The delta of the Mississippi. Jour. Geogr. **3**: 204–213. *map* + *f. 2–9.* My 1904.

Loew, E. Die Bestäubungseinrichtung von *Pentastemon Menziesii* Hook. und verwandter Arten. Festschr. 70-ten Geburtst. Ascherson, 58–67. 1904.

Lopriore, G. Gli staminodi della Amarantacee dal punto di vista morfologico, biologico e sistematico. Festschr. 70-ten Geburtst. Ascherson, 413–430. *f. 1–39.* 1904.

MacDougal, D. T. Delta and desert vegetation. Bot. Gaz. **38**: 44–63. *f. 1–7.* 16 Jl 1904.

Macloskie, G. The ascent of water in trees. Science, II. **20**: 116–118. 22 Jl 1904; 246. 19 Au 1904. [Illust.]

Massee, G. A monograph of the genus *Inocybe* Karsten. Ann. Bot. **18**: 459–502. *pl. 32.* Jl 1904.

Of the 112 species recognized, 36 are from America, all these being from the United States.

Moore, R. A. Grain smut and its prevention. Wis. Agric. Exp. Sta. Bull. **111**: 1–10. *f. 1, 2.* Mr 1904.

Morgan, A. P. New species of *Pyrenomycetes.* Jour. Myc. **10**: 161, 162. 24 Je 1904.

New species of *Trichosphaeria, Trematosphaeria, Bertiella, Enchnosphaeria, Acanthostigma* and *Hypoxylon.*

Morgan, A. P. *Tuberculariа fasciculata* Tode. Jour. Myc. **10**: 97, 98. 21 My 1904.

Morris, D. Improvement of the sugar cane by selection and cross fertilization. Mem. Hort. Soc. N. Y. **1**: 79–86. *f. 1–10.* [1904.]

Murrill, W. A. The *Polyporaceae* of North America — VIII. *Hapalopilus, Pycnoporus* and new monotypic genera. Bull. Torrey Club, **31**: 415–428. 26 Au 1904.

The new monotypic genera are *Abortiporus, Cyclomycetella, Cycloporus, Globifomes, Nigrofomes* and *Poronidulus.*

Nash, G. V. The botanical meeting at McCall's Ferry, Pennsylvania. Torreya, **4**: 117–119. 27 Au 1904.

Nash, G. V. A collecting trip to Haiti. Torreya, **4**: 100–104. 21 Jl 1904.

Nash, G. V. The validity of the genus *Paratheria* Griseb. Torreya, **4**: 122, 123. 27 Au 1904.

Norton, J. B. Improvement of oats by breeding. Mem. Hort. Soc. N. Y. **1**: 103–108. [1904.]

Orton, W. A. On the breeding of disease-resistant varieties. Mem. Hort. Soc. N. Y. **1**: 41–52. *pl. 1–4.* [1904.]

Pammel, L. H. Hybrids and diseases. Mem. Hort. Soc. N. Y. **1**: 229, 230. [1904.]

Parish, S. B. A preliminary synopsis of the Southern California *Cyperaceae*. Bull. So. Cal. Acad. Sci. **3**: 65–68. *pl. 5*. 24 My 1904; 81–86. *pl. 6–8*. 12 Jl 1904.
Includes *Eleocharis disciformis* sp. nov.

Parlin, J. C. A new station for *Nyssa sylvatica* in Maine. Rhodora, **6**: 164. 14 Jl 1904.

Parlin, J. C. Some causal elements in the flora of western Maine. Rhodora, **6**: 81–84. 2 My 1904.

Pease, A. S. Preliminary lists of New England plants, XV. Rhodora, **6**: 85–88. 2 My 1904.

Perkins, J. Carl Schumann. A biographical sketch. Bot. Gaz. **38**: 143–145. *portrait*. 18 Au 1904.

Perkins, J. Fragmenta flora Philippinae: contributions to the flora of the Philippine Islands, **1**: 67–152. *pl. 1–3*. Leipzig, 30 Je 1904.
Includes decriptions of numerous new species.

Prescott, E. A photographer goes a-botanizing to Yosemite. Camera Craft, **8**: 110–116. F 1904. [Illust.]

Rehm, H. *Ascomycetes* Americae borealis, II. Ann. Myc. **2**: 351–354. 31 Jl 1904.
Includes new species in *Plicaria*, *Tarzetta* and *Gorgoniceps*.

Rendle, A. B. The classification of flowering plants. **1**: i–xiv. 1–403. *f. 1–187*. Cambridge, 1904.
Gymnosperms and monocotyledons; there are, of course, many references to American plants.

Rick, J. Ueber einige neue und kritische Pilze Süd-Amerikas. Ann. Myc. **2**: 242–247. 31 My 1904. [Illust.]
New species in *Michenera*, *Hydnum* (2), *Clitocybe*, *Rickiella* Syd. gen. nov., *Orbicula*, *Masseea* and *Midotis*.

Ricker, P. L. Notes on fungi, I. New or interesting American *Uredineae*. Jour. Myc. **10**: 165–167. 24 Je 1904.
Includes *Aecidium Williamsii* sp. nov.

Roberts, H. F. A wheat-rye hybrid. Science, II. **20**: 248, 249. 19 Au 1904.

Robinson, B. L. James Lawrence Bennett. Rhodora, **6**: 146, 147. 15 Je 1904.

Robinson, B. L. *Stellaria glauca* established in the province of Quebec. Rhodora, **6**: 90, 91. 2 My 1904.

Robinson, B. L. & Greenman, J. M. Revision of the genus *Sabazia*. Proc. Am. Acad. Arts & Sci. **40**: 3–6. 18 Jl 1904.

Robinson, B. L. & Greenman, J. M. Revision of the Mexican and Central American species of *Hieracium*. Proc. Am. Acad. Arts & Sci. **40**: 14–24. 18 Jl 1904.
With descriptions of 5 new species.

Robinson, B. L. & Greenman, J. M. Revision of the Mexican and Central American species of *Trixis*. Proc. Am. Acad. Arts & Sci. **40**: 6–14. 18 Jl 1904.
With descriptions of 5 new species.

Rosenstock, E. Beiträge zur Pteridophytenflora Südbrasiliens. Hedwigia, **43**: 210–238. 12 Je 1904.
Includes new species in *Asplenium*, *Nephrodium* and *Selaginella* (2).

Russell, H. L. Black rot of cabbage. Ann. Rep. Wis. Agric. Exp. Sta. **20**: 259–262. *f. 25, 26.* 1904.

Rydberg, P. A. Studies on the Rocky Mountain flora — XI. Bull. Torrey Club, **31**: 399–410. 29 Jl 1904.
With descriptions of 25 new species and varieties in 16 genera.

Sandsten, E. P. Spraying fruit trees. With notes on the common insects and fungus diseases infesting orchards. Wis. Agric. Exp. Sta. Bull. **110**: 1–28. *f. 12.* Ap 1904.

Sanford, S. N. F. The occurrence of *Verbena stricta* and *Helianthus mollis* in Massachusetts. Rhodora, **6**: 88, 89. 2 My 1904.

Saunders, C. E. Notes on some variations in the second generation of *Berberis* hybrids. Mem. Hort. Soc. N. Y. **1**: 167, 168. [1904.]

Saunders, W. Results of hybridization and plant breeding in Canada. Mem. Hort. Soc. N. Y. **1**: 125–141. [1904.]

Schaffner, J. H. Deciduous leaves. Ohio Nat. **4**: 163–166. 1 My 1904.

Schaffner, J. H. The jacket layer in *Sassafras*. Ohio Nat. **4**: 192, 193. *f. 1.* 1 Je 1904.

Schiffner, V. Beiträge zur Aufklärung einer polymorphen Artengruppe der Lebermoose. Verh. Zool.-bot. Gesells. Wien, **54**: 381–405. 30 Jl 1904.

Schneider, A. A guide to the study of lichens. Ed. 2. i–xii. 1–234. *pl. 1, 1a–1d, 2–6, 1–11.* Boston, 1904.

Schumann, K. Mais und Teosinte. Festschr. 70-ten Geburtst. Ascherson, 137–157. 1904.

Selby, A. D. Peach diseases III. Ohio Agric. Exp. Sta. Bull. 148: 55–67. *pl. 1–7.* F 1904.
Peach leaf-curl and scab.

Seler, E. Zwei Frühlingsmonate in Yucatan. Festschr. 70-ten Geburtst. Ascherson, 371–382. 1904.

Shafer, J. A. Notes on Cuban plants. Torreya, **4**: 105. 21 Jl 1904.

Shaw, C. H. Note on the sexual generation and the development of the seed-coats in certain of the *Papaveraceae*. Bull. Torrey Club, **31**: 429–433. *pl. 15*. 26 Au 1904.

Sheldon, J. L. Some introduced weeds of Connecticut. Rhodora, **6**: 146. 15 Je 1904.

Smith, A. M. Notes on rare or little known mosses. Bryologist, **7**: 51. 52. 2 My 1904.

Smith, C. O. A new egg-plant fungus. Jour. Myc. **10**: 98, 99. *f. 1–6*. 31 My 1904.

Referred with some doubt to *Ascochyta Lycopersici* Brun.

Smith, R. E. The water-relation of *Puccinia Asparagi*. Bot. Gaz. **38**: 19–43. *f. 1–21*. 16 Jl 1904.

Solms-Laubach, H. Graf zu. Ueber die Schicksale der als *Psaronius brasiliensis* beschriebenen Fossilreste unserer Museen. Festschr. 70-ten Geburtst. Ascherson, 18–26. 1904. [Illust.]

Spalding, V. M. Biological relations of certain desert shrubs. I. The creosote bush (*Covillea tridentata*) in its relation to water supply. Bot. Gaz. **38**: 122–138. *f. 1–7*. 18 Au 1904.

Sprague, T. A. *Sinningia Regina* Sprague, n. sp. Gard. Chron. III. **36**: 87, 88. 6 Au 1904.

Supposed to be a native of Brazil.

Sydow, H. & P. Neue und kritische Uredineen, III. Ann. Myc. **2**: 349–351. 31 Jl 1904.

Includes a new species of *Uromyces* from Cuba, and one of *Uredo* from Mexico.

Tracy, W. W. The influence of climate and soil on the transmitting power of seeds. Science, II. **19**: 738–740. 6 My 1904.

Tracy, W. W. Variant tendency and individual prepotency in garden vegetables. Mem. Hort. Soc. N. Y. **1**: 75–78. [1904.]

Transeau, E. N. On the development of palisade tissue and resinous deposits in leaves. Science, II. **19**: 866, 867. 3 Je 1904.

Trask, B. Flora of San Clemente Island. I. Bull. So. Cal. Acad. Sci. **3**: 76–78. 24 My 1904; — II. Bull. So. Cal. Acad. Sci. **3**: 90–95. 12 Jl 1904.

Ule, E. Blüteneinrichtungen von *Amphilophium*, einer Bignoniacee aus Südamerika. Festschr. 70-ten Geburtst. Ascherson, 547–551. 1904.

With a description of *A. Aschersonii* sp. nov., from Peru.

Ule, E. Myxomyceten aus Amazonas. Hedwigia, **43**: 300–304. *f. 1, 2*. 12 Je 1904; 305. 15 Jl 1904.

Including a new genus, *Iocraterium*, based on *Craterium rubescens* Rex.

Urban, I. Ueber einige Celastraceen-Gattungen. Festschr. 70-ten Geburtst. Ascherson, 48–58. 1904.
A discussion of *Myginda* and the various species that have been referred to it.

Waldron, C. B. Trees and fruit in North Dakota. N. Dak. Agric. Exp. Sta. Bull. 59: 355–385. *pl. 1–7.* Mr 1904.

Ward, L. F. Paleozic seed plants. Science, II. **20**: 279–281. 26 Au 1904.

Ward, L. F. The *Pteridospermaphyta.* Science, II. **20**: 25, 26. 1 Jl 1904.

Wildeman, E. de. *Layia calliglossa* As. Gray. Ic. Sel. Hort. Thenensis, **5**: 9–12. *pl. 163.* F 1904.
Native of California.

Wildeman, E. de. *Pharbitis Learii* Lindl. Ic. Sel. Hort. Thenensis, **5**: 13–16. *pl. 164.* F 1904.
Native of Mexico and South America.

Woodward, R. W. Two noteworthy plants of New Haven, Connecticut. Rhodora, **6**: 89, 90. 2 My 1904.

Wright, C. H. *Pitcairnia spathacea.* Curt. Bot. Mag. III. **60**: *pl. 7966.* 1 Jl 1904.
Native of Argentina.

York, H. H. The embryo-sac and embryo of *Nelumbo.* Ohio Nat. **4**: 167–176. *pl. 16–18.* 1 Je 1904.

Zahlbruckner, A. Neue Flechten. Ann. Myc. **2**: 267–270. 31 My 1904.
Includes *Graphina Bakeri* sp. nov., from Nicaragua.